POWER TOOLS and EQUIPMENT

This text introduces a variety of subject matter related to Building and Construction, at a basic level.
It should be read in conjunction with "Basic Building and Construction Skills" , produced by TAFE and Addison, Wesley, Longman Australia Pty Limited, as between them they address the following:

A range of basic power tools and associated equipment is introduced, which includes the portable power saw, router, planer, drill, drop saw, Radial arm saw, drop/slide saw and nail gun.

Safety and maintenance procedures are outlined to ensure that safe and effective use of these tools is carried out.

Note: Jig saws, angle grinders, sanders, drills, jack hammers, leads and hoses, including safety procedures, proper maintenance and safe use of these tools, is dealt with in *"Basic Building and Construction Skills".*

A comprehensive *'Glossary of Terms'* is included at the end of the text, which provides a detailed description of trade terms, technical content and some trade jargon.

INTRODUCTION

Unlike hand tools, which can be traced back to ancient times, power tools are considered to be a recent innovation evolving over the past fifty years or so.
At first these power tools were heavy, cumbersome, extremely dangerous and lacking in safety features. Today power tools are highly sophisticated, lightweight and double insulated to prevent electrocution. In addition, many power tools have a range of additional features which make them invaluable tools for the trades person. It could be said that the tradesperson of today could not operate a business successfully without a comprehensive kit of modern power tools.
It has also been said that power tools can perform the same task as hand tools, only faster and better, however to make this statement the tradesperson would need to have acquired the necessary skills to use these power tools safely and accurately.
With this in mind, the following section is designed to introduce the most commonly used power tools in the Building Industry.

DEFINITIONS

Portable Power Tools: are basically hand tools which may be driven by an AC or DC electric current or by compressed air. As they are not fixed to a floor or a bench, and are relatively compact, they can be easily transported to the worksite.

Machine Tools: are tools usually fixed in place, or are too large to transport easily, which requires the user to take the job to the machine.
(These tools are not addressed in this text.)

Power tools are grouped into three main categories:
1. Cutting
2. Fixing
3. Finishing
NB: *Only power tools in the cutting range are considered in this module, refer to "Basic Building and Construction Skills" for Fixing and Finishing tools.*

CUTTING

PORTABLE CIRCULAR POWER SAW

There are many types of powered saws used within the building industry such as the jig saw, chain saw, brick cutting saw, mitre saw, and sabre saw, with the portable circular saw being the most common.
Circular saws are available in a variety of sizes (184 mm to 260 mm), with the name of the saw being governed by its blade size, and may be used for many cutting operations such as:

- Ripping
- Crosscutting
- Compound cutting
- Grooving
- Rebating
- Trenching

Most portable electric saws operate at speeds of 4,000 - 5,000 r.p.m. which means that a 225 mm saw blade with 96 teeth rotating at 4,000 r.p.m, will have the equivalent of 384,000 teeth in contact with the timber each minute.
A hand saw 600 mm long and seven teeth per 25 mm, if used by a tradesperson cutting at 60 strokes per minute, would have the equivalent of only 10,080 teeth in contact with the timber per minute, which explains why power tools are so fast and efficient.

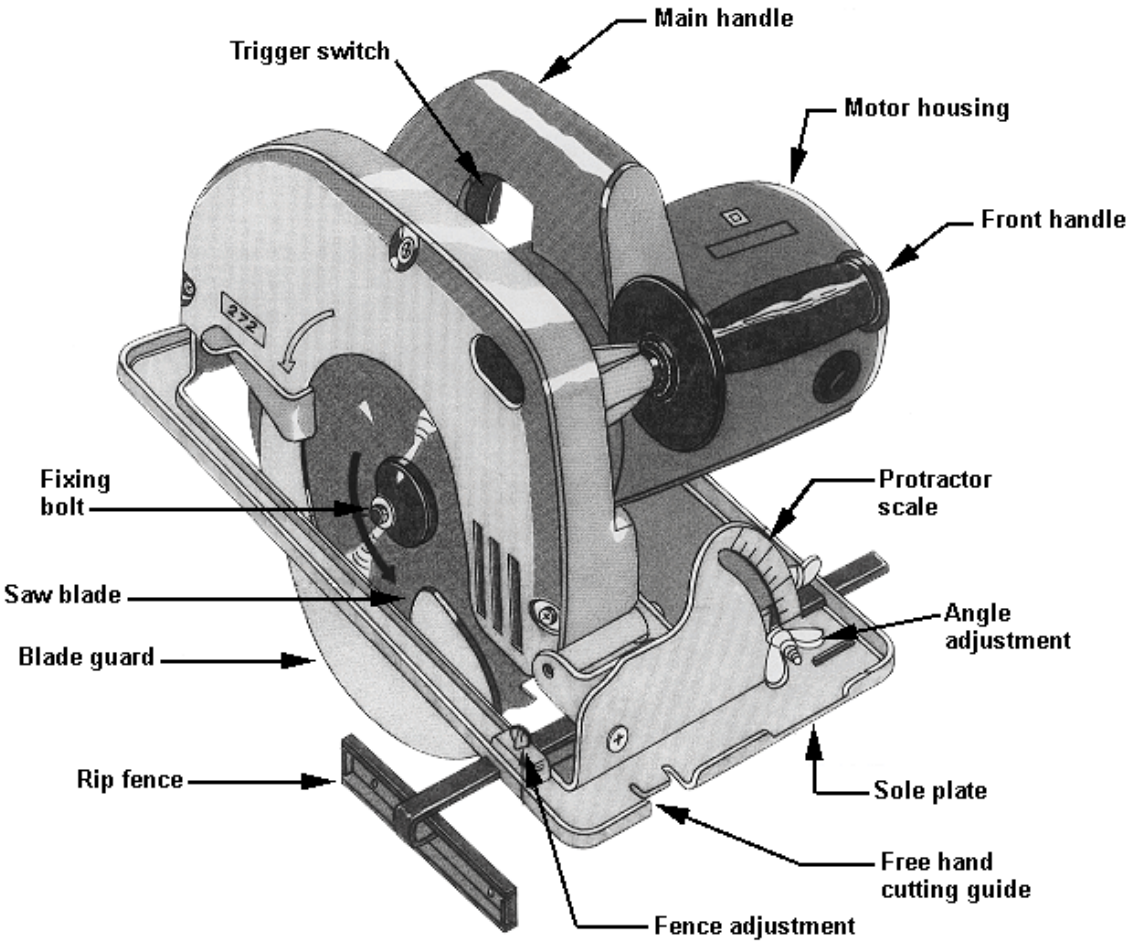


Fig. 1 Typical Portable Power Saw

SAFE OPERATION AND USE OF THE PORTABLE POWER SAW

To use the portable power saw ***CORRECTLY*** and ***SAFELY*** you **MUST:**

- check all adjustments are tightened before use;
- the saw must be fitted with a hood guard and a spring guard. The spring guard below the guide plate must operate freely and return to cover the blade when not in use;
- never tie the guard back;
- operate the saw with both hands;
- do not force the saw. If it stalls or loses speed, free the blade by pulling the saw back. Wait for the saw to regain full speed before continuing the cut;
- after the cutting operation is complete, check to ensure the guard springs back to the closed position before placing on any surface;
- always switch off before removing the saw from the timber;
- rest the saw on blocks when not in use, to prevent damage to the guard;
- keep fingers and hands clear of the blade;
- use the correct type of blade for the work being performed;
- never use the saw above your head;
- do not stretch to make a cut;
- switch off the power and remove the plug before making any adjustments to the saw;
- unless governed to a depth of cut, the blade should be set to full depth at all times to prevent kickback and provide optimum performance;
- keep the work area clean and free from off-cuts;
- always wear safety glasses and hearing protection;
- select a saw with sufficient power and depth of cut;
- keep the blade sharp at all times;
- the base plate must always be in firm contact with the material;
- never attempt to curve cut with a straight blade. Twisting the saw in the kerf will result in kickback;
- the front of the base plate must rest on the material before the saw is switched on;
- the material to be cut must be firmly secured before cutting. A cutting guide can be used when making long rip cuts and for accurate cross cutting; and
- all extension leads must be well behind the saw and run up and over the operators shoulder to ensure it does not drop under the work being cut.

USING THE SAW

RIPPING

The material being cut should be well secured, i.e. it should be cramped or nailed to a bench, solid surface or to saw stools. This will allow both hands to control the saw so an even pressure may be applied. As the saw passes along the length of the timber being ripped the section already cut tends to close in on the blade, which can lead to jamming, labouring of the motor or even kickback. To prevent this occurring most saws are fitted with a 'riving knife', but when this is not fitted the operator may insert a wedge or a chisel in the cut behind the saw to prevent the saw kerf closing. A fence guide may be fitted to the saw for parallel cutting.

***Note**: The dust collection bag has been removed to allow detail to be seen.*

Fig. 2 Ripping solid timber

When ripping sheet material beyond the capacity of the standard fence guide it is necessary to support the sheet on either side underneath the cut. This will allow the blade to pass through without cutting the stools or bench below and also prevents the sheet dropping against the blade.

Fig. 3 Ripping sheet material

CROSSCUTTING

The material may be cramped, nailed or held with a knee onto the saw stool while the saw cuts across the width of the timber or sheet material. A guide may be cramped or nailed to the face of the material to be cut allowing the sole plate to be pushed up against it, which will ensure a straight cut. This is particularly useful when cutting wide or sheet material.

Note: *When ripping or crosscutting thin material, the spring guard should be pulled back to start the cut otherwise it may jam due to the leading edge not striking the timber allowing it to slide underneath.*

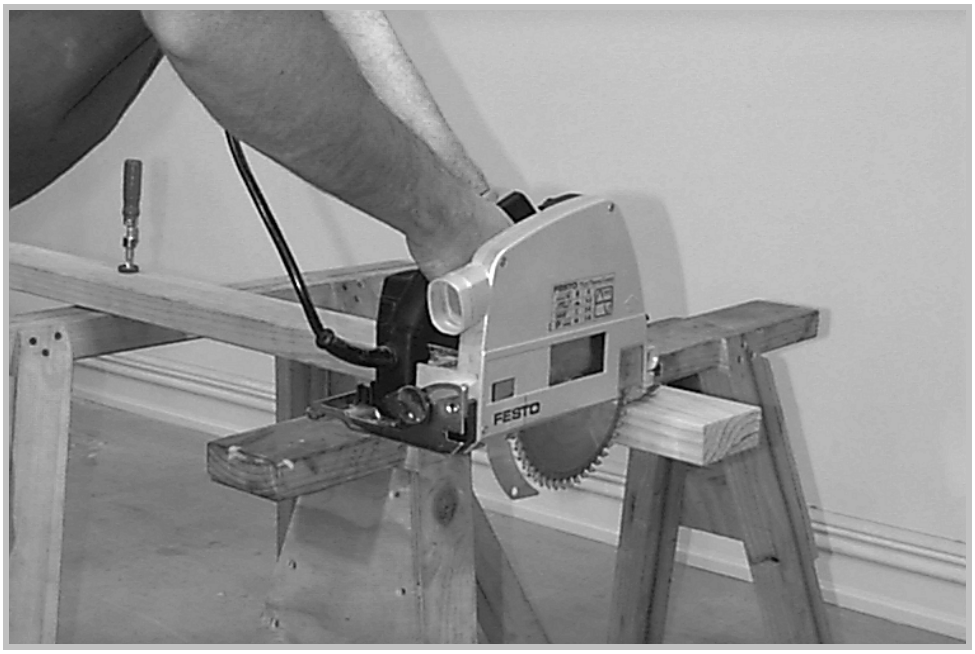


Fig. 4 Crosscutting solid timber

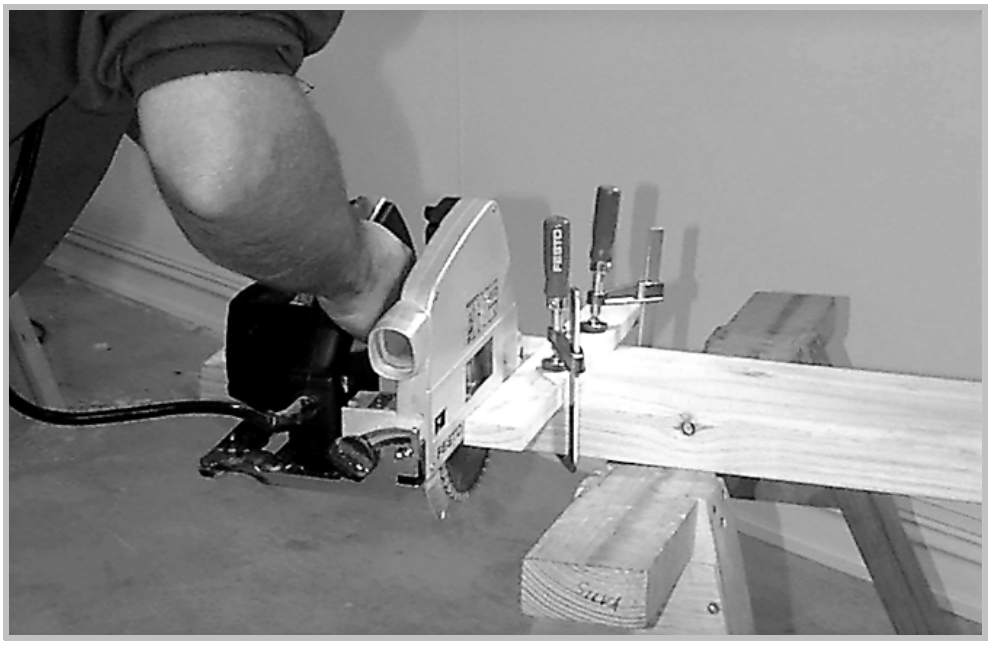


Fig. 5 Crosscutting wide material

COMPOUND CUTTING

Materials may be compound cut, i.e. where there is an angle on the face and edge of the one cut, using a special guide called a 'protractor', which is set at the desired face angle and held down firmly on the face. The sole plate of the saw is tilted to create the desired angle for the edge. This is very useful when cutting the ends of creeper rafters for a hipped roof.

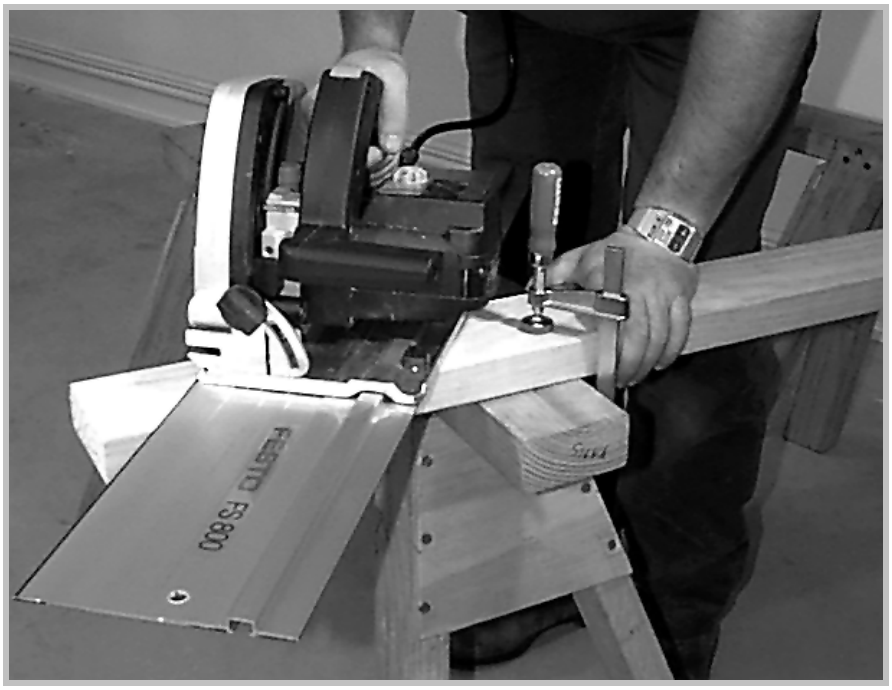


Fig. 6 Using a protractor for compound cutting

REBATING and GROOVING

When *rebating* timber, the saw is fitted with a standard fence guide and set to the required width from an edge, set to depth and run the full length of the timber. It is then set to the required distance from the face, set to depth and run the full length of the timber which allows a full length square or rectangular piece to be removed.

This may also be achieved by use of a patent type guide plate or a timber fence nailed to the job a distance equal to the width of the sole plate plus the amount of rebate required, less the thickness of the blade. This is generally used for wide boards.

The same procedures may be used when *grooving* timber on the face and/or edge, however when grooving the bottom edge of a sliding door, the door must be held securely over a bench or saw stool in an upright angle to allow safe cutting.

Fig. 7 Rebating using a special patent fence guide

Fig. 8 Grooving using a special patent fence guide

Fig. 9 Grooving the bottom edge of a sliding door

Trenching

The saw is set to the required depth for the trench, which may be approx. 10 mm in wall plates to take studs, and run across the timber on the waste side of the marks. An additional one or two relief cuts in the centre section of the trench will allow for easier chiselling later. A protractor set to 90° may also be used as a guide to ensure a straight cut.

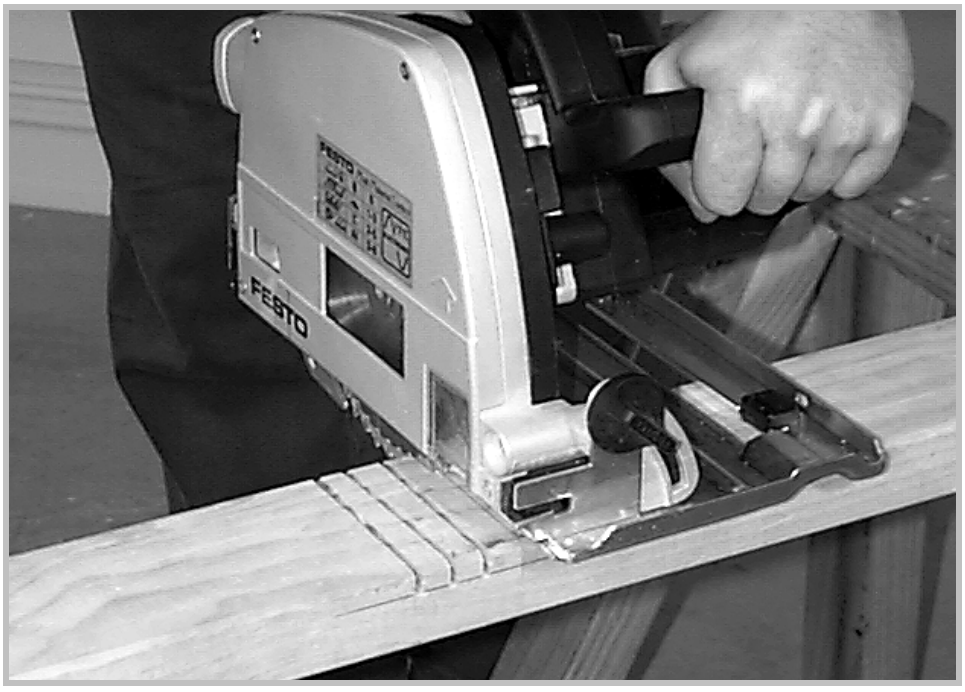


Fig. 10 Trenching wall plates

POCKET CUTTING

When a jig saw is not available, pocket or internal cuts may be made using the power saw, provided the following procedures are adopted:

- the toe of the sole plate must be held down firmly and in contact with the job;
- the heel of the saw is lifted slightly and the spring guard is pulled back, using the retracting handle, only enough to allow the blade to make contact with the job and then released;
- the saw is started and dropped slowly at the heel making sure it does not move backwards, otherwise it may cause kickback. Holding the saw firmly, move it forwards to make the cut; and
- when the cut is complete wait until the saw has stopped before removing it from the kerf.

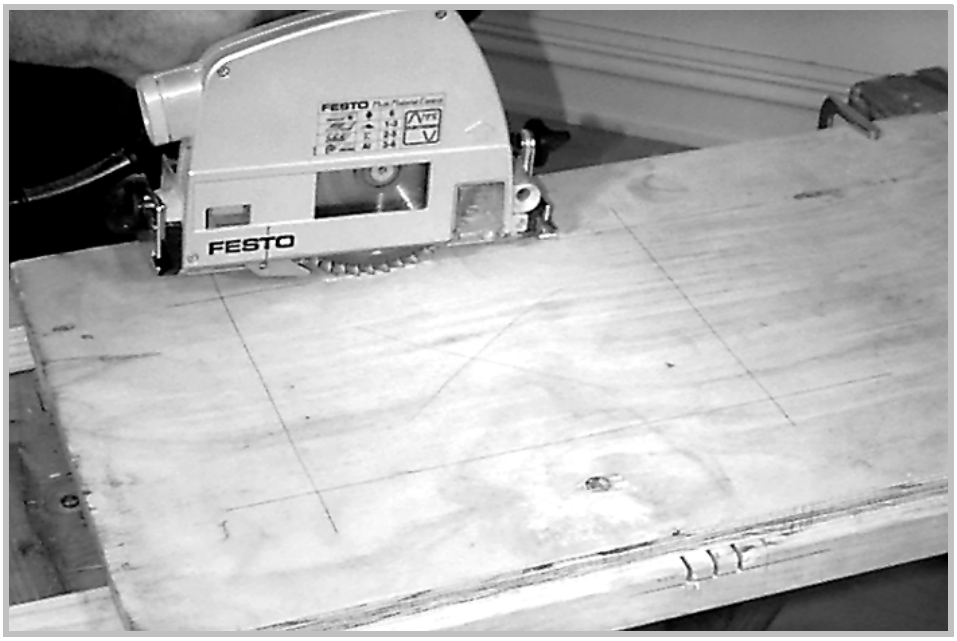


Fig. 11 Safe pocket cutting

SHARPENING SAW BLADES

Generally it is only plain steel blades which are sharpened on the job as tungsten carbide tipped blades require specialist sharpening procedures to ensure a proper result. If sharpening is required the following steps may be used as a guide:

STEP 1 ***Jointing or Topping -*** This is carried out to correct irregularities on the circumference of the teeth. An abrasive stone or oilstone brings the periphery to a near perfect circle. A safety cover is used to protect the operator. Keep the jointing stone moving across the blade edge otherwise the blade may cut grooves into the stone, resulting in rounding of the edges.

STEP 2 ***Shaping -*** This is the act of filing the teeth to a correct shape while holding the blade in a circular cramp.

STEP 3 ***Setting -*** Using a circular saw set, each alternate tooth is set either towards or away from the operator. This provides clearance for the blade in the kerf similar to that of a hand saw.

STEP 4 ***Sharpening -*** The *Combination* saw blade teeth are topped to a common level. Alternate teeth are filed from one side, the blade is reversed and the remaining teeth are filed from the other side. They are filed until a point is produced and any flat section is removed.
A round edged mill file is used to shape the teeth, as opposed to a triangular file, which might create nicks in the gullet leading to a weakness and possible snapping off of the teeth.

Note: *Rip, crosscut and special type blades require a similar treatment although the sharpening angles will vary, as shown below:*

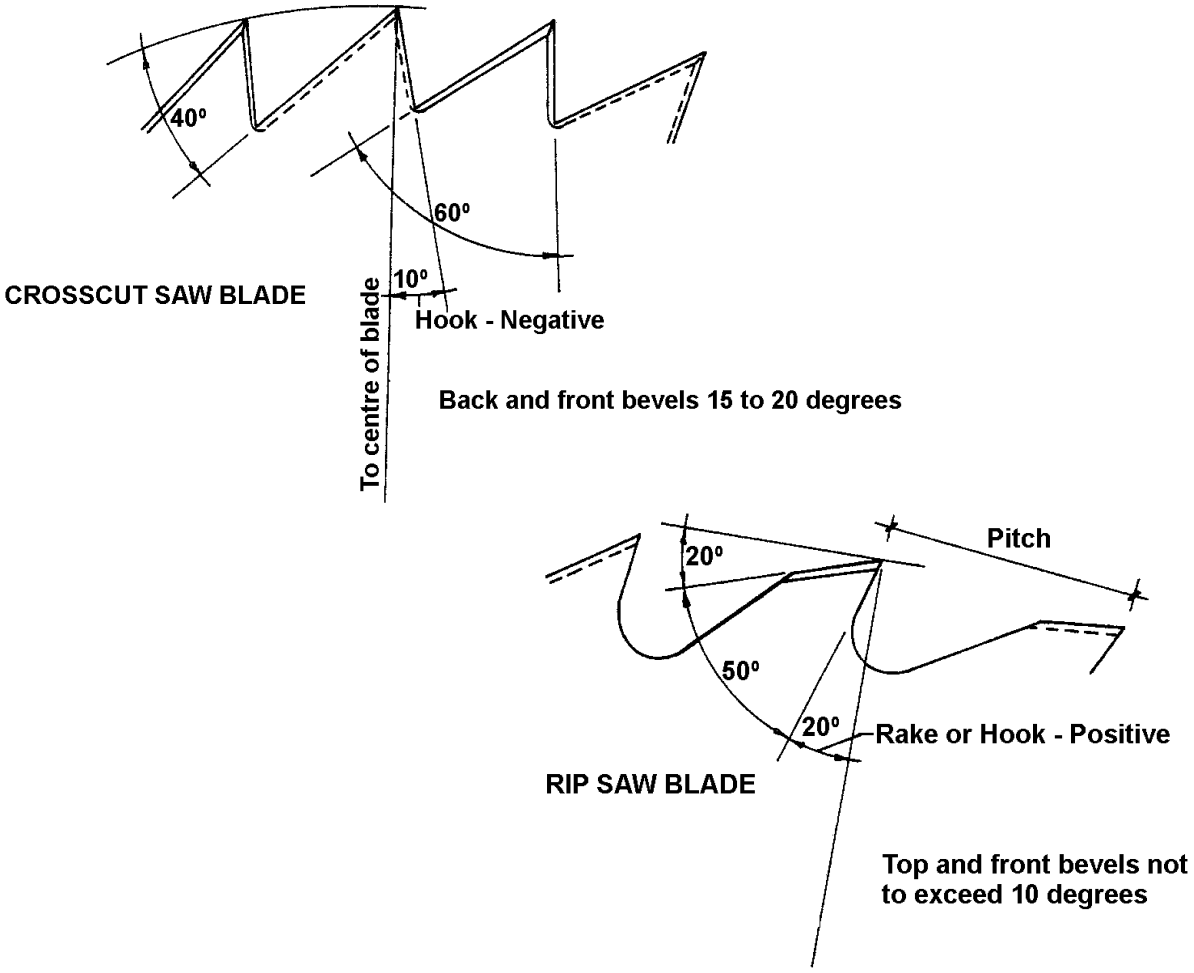


Fig. 12 Rip and Crosscut sharpening angles

STEP 5 ***Gumming or Skimming -*** Use a gulleting wheel or a round file to lightly touch up the gullet to remove any accumulated resin or nicks, caused by tooth sharpening.

STEP 6 ***Gulleting -*** This is the process of shaping and deepening the gullets which may occur due to excessive sharpening reducing the teeth in size. This re-shaping should be carried out by an experienced Saw Doctor.

STEP 7 ***Dressing -*** This is carried out carefully while the saw is running allowing the outsides of the teeth to touch a silicon carbide stone, which brings the points into line.

PORTABLE ELECTRIC ROUTER

The portable electric router is a high speed spindle moulder and shaper, which may be used in the workshop or on-site. The versatility of the router lies in the variety of bits and cutters that are designed for its use and unlike the joinery shop fixed bench type spindle moulder, it is portable.

It has a high speed revolving cutter (20,00 - 27,000 r.p.m) that gives a very neat, clean cut. There are a wide range of routers available, which have differing power and speed ratings to suit a variety of work. They are usually purchased with accessories such as an adjustable fence, template guide etc.

Routers fall into two (2) main categories:

1. **Standard Routers**

2. **Plunge Routers**

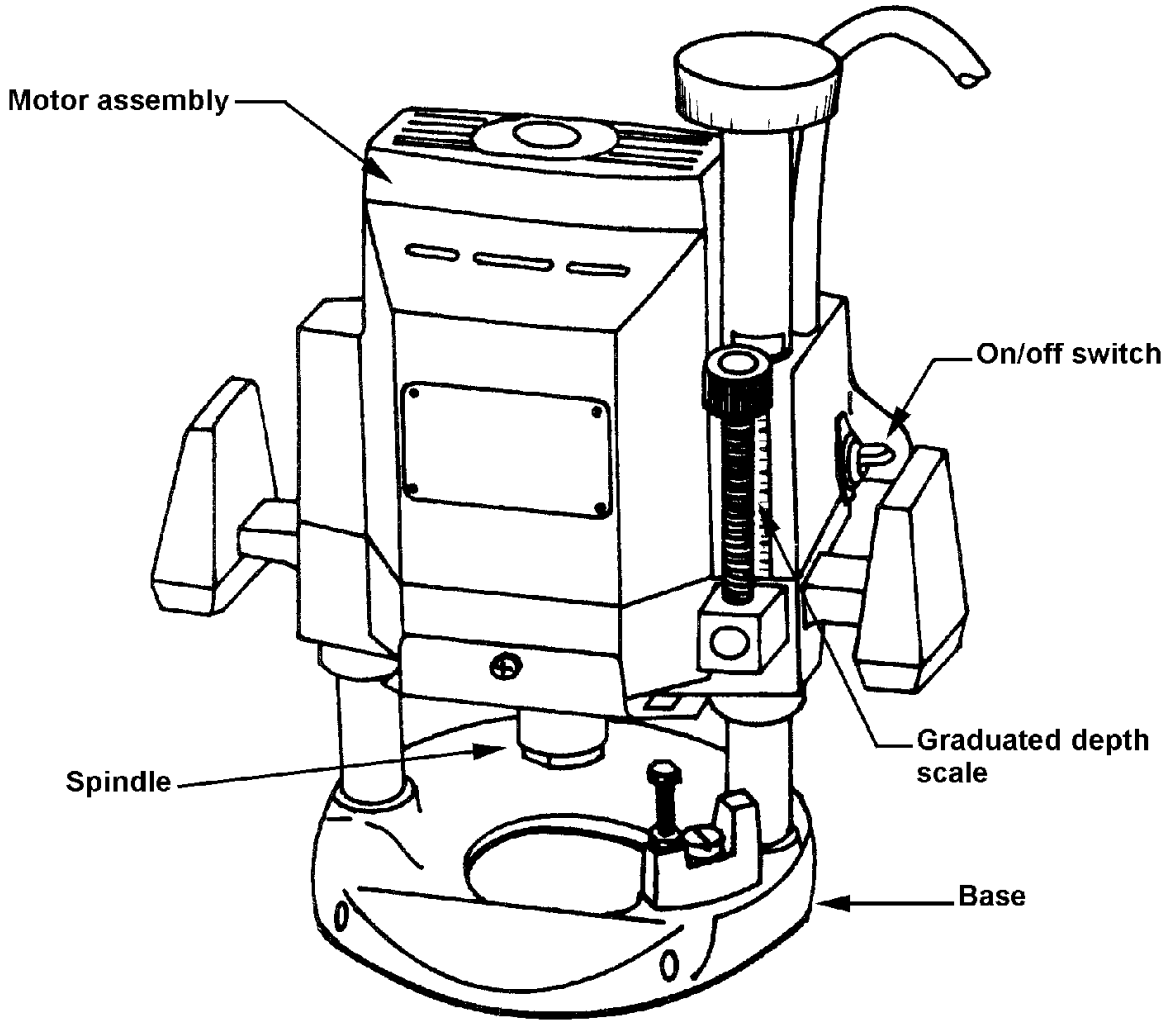


Fig. 13 Parts of a portable router

Standard Router

The standard type has an adjustable base which screws in or out to gain the required cutter depth. With this type of router the cutter protrudes past the base plate at all times, therefore care must be taken to avoid contact with other materials, including the operators fingers.

Fig. 14 Typical Standard Router with screw adjustment

Plunge Router

This type is a fairly recent development with the advantage of having the base plate spring loaded.

When the machine is not in use the base is fully extended and covers the cutter, protecting the operator and the cutter from accidental damage.

Most of these machines have a number of adjustable stops, which can be preset to the depth of the cut required.

Fig. 15 Typical Plunge Router - spring loaded

SAFE OPERATION AND USE OF THE PORTABLE ELECTRIC ROUTER

To use the electric router ***CORRECTLY*** and ***SAFELY*** you **MUST:**

- always wear safety glasses and hearing protection;
- make sure the *collet* and *bit* shanks are clean;
- always ensure the cutters are sharp;
- after installing the cutting bit ensure the collet nut is tightened firmly;
- oil external faces of the spring pillars on the plunge router frequently to ensure smooth operation;
- before connection to power outlet ensure that all adjustments are tight, the cutting bit moves freely and the switch is **OFF;**
- the depth of the cut may vary, depending on the hardness of the timber being cut. It is more practical to take three light cuts rather than one heavy cut;
- operate the router in the correct direction of feed in relation to the bit rotation, as shown below. Note that the direction of rotation is *clockwise* when viewed on plan:

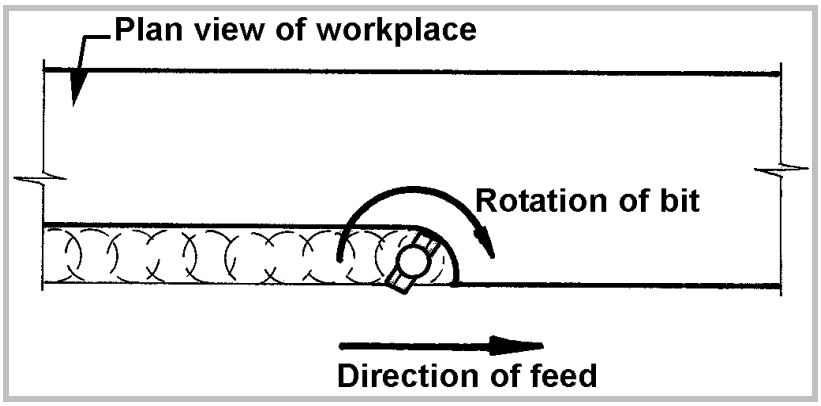


Fig. 16 Feed Direction

- hold the machine firmly with both hands while operating;
- ensure that the motor has completely stopped before removing the router from the work;
- always lay the router on its side with the exposed cutter away from the operator when not in use; and
- use a fence, guide, bits with pilot bearings or a template wherever possible.

ROUTER USES

REBATING

A square or rectangular section along the edge and/or end of timber may be removed by using a rebating bit fitted with a pilot bearing or an adjustable fence set to the required distance from the edge.

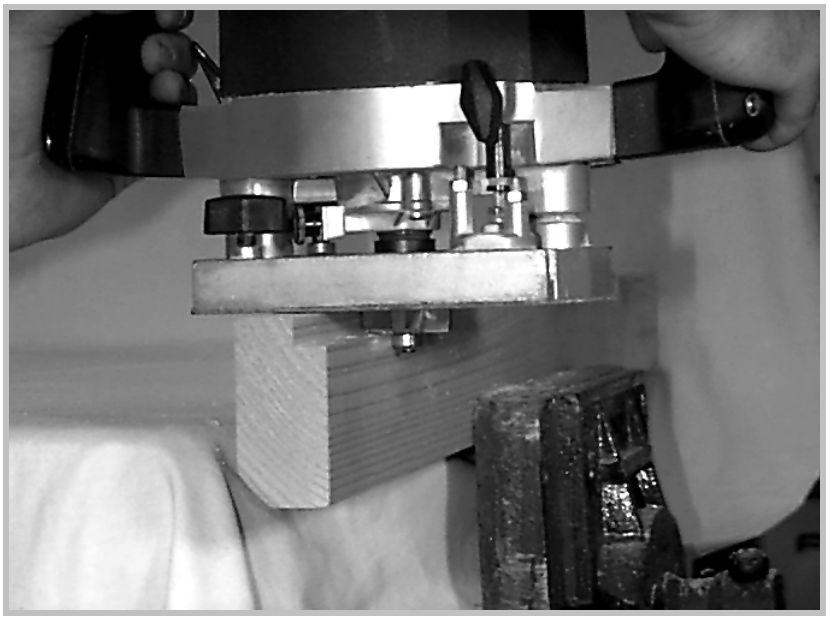


Fig. 17 Rebating the edge of timber

GROOVING and FLUTING

Grooves may be cut in the face or edge of timber using the following:

- a straight cutter set to depth and an adjustable fence, for grooving the face of timber; or
- a slotting cutter with a set depth, fitted with a pilot bearing, for grooving the edge of timber.

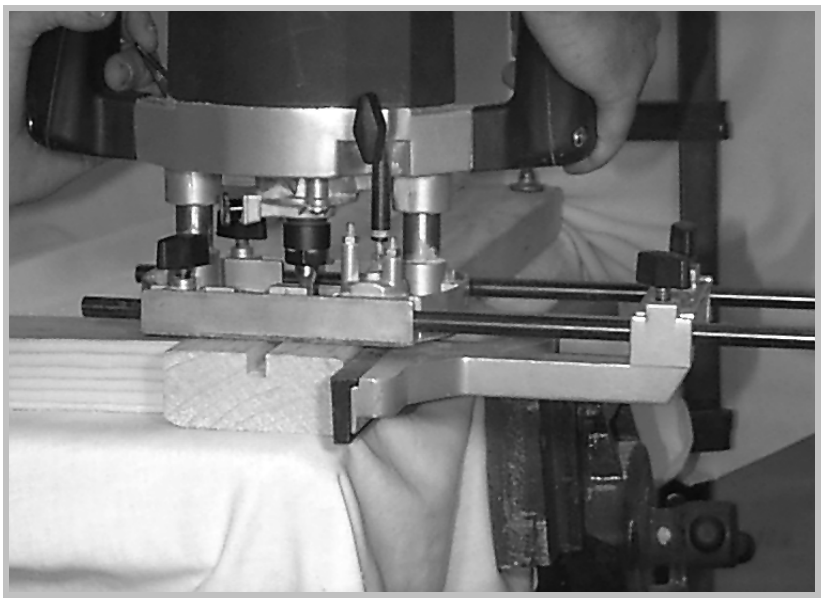


Fig. 18 Grooving the face of timber

MORTICING

A plunge router is suited for this operation and may be used with a morticing jig when creating joints in the edge of timber or when fitting a mortice lock. Longer shank straight cutters are available for this type of work with the diameter of the cutter creating the correct width mortice for the job.

Fig. 19 Using the router for morticing

TRIMMING

The edge of plastics, plastic laminates, veneers, etc. may be trimmed using a special trimming bit and adjustable fence or one which is fitted with a pilot bearing. This is an ideal way of finishing the edge of laminated kitchen cupboard tops, office furniture, etc. Also, smaller special purpose trimmers may be used instead of the larger router.

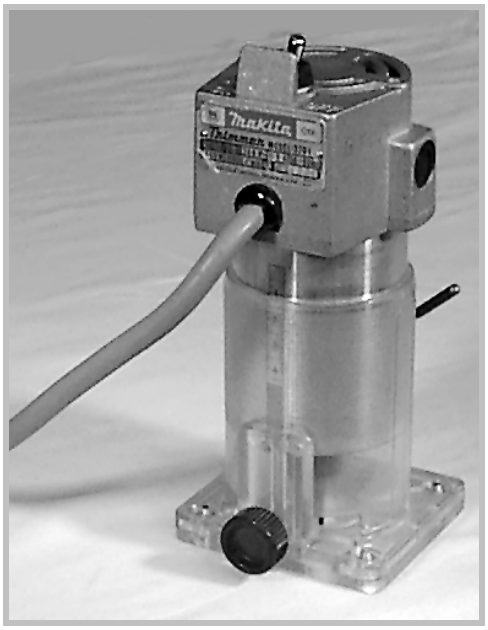


Fig. 20 Special purpose edge trimmer

EDGE MOULDING

A variety of simple or complex edge moulds may be created using specially designed cutter bits in conjunction with an adjustable fence or using those bits which are fitted with a pilot bearing. Simple chamfers through to classical thumb moulds may be produced using bits which have the reverse shape formed on the cutters.

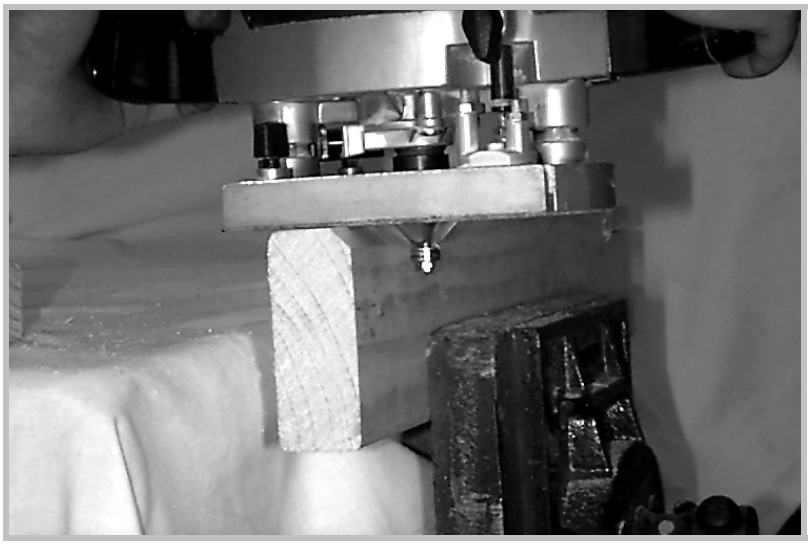


Fig. 21 Forming edge mouldings

TEMPLATE CUTTING

The plunge router is the best suited tool for this operation as it can be lifted and moved repeatedly with safety, as the cutter will be protected above the base plate. Templates are used where multiples of the same shape are required or a complex shape is to be formed on the face, such as the cutting of raised panels in a solid core door. A special 'template guide' is fitted to the base plate of the router which allows the inside template shape to be followed accurately and smoothly, such as the stair riser/tread template below:

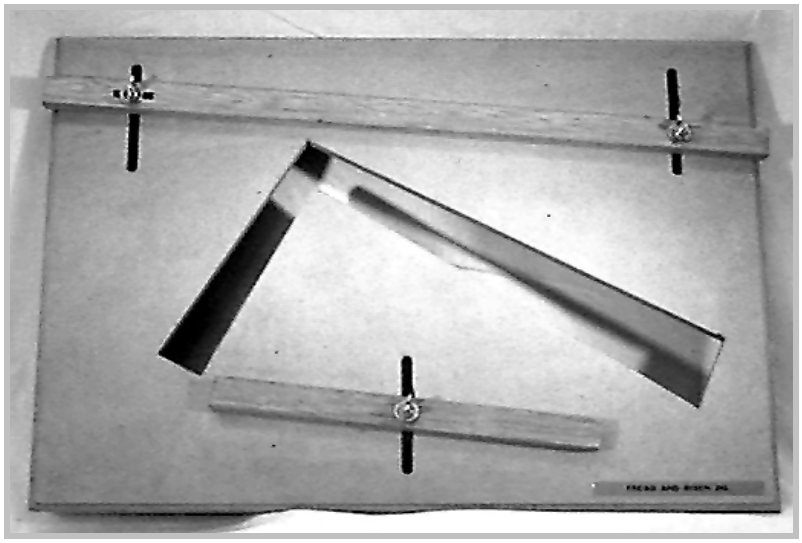


Fig. 22 A typical template used with the router for stair strings

There are a variety of other types of accessories for a wide range of applications, such as jigs for dovetailing and hinge cutting, trimming attachments for edge trimming, router tables, overhead routering and a router press.

ROUTER BITS

As previously mentioned, there are special bits with shaped cutting edges for special jobs. They may be of ground tool steel or fitted with tungsten carbide cutters. The tungsten cutters provide a superior cutting edge which remains keen for longer, especially when used on very hard timbers or abrasive materials such as particleboard and fibreboard.
The most common diameter shanks are 6 mm and 12 mm, with the larger shanks recommended for heavy work and high speed routers. The router should ***never*** be forced when cutting, especially when 6 mm bits are used, as the heads have been known to shear off under load causing job damage and operator injury.
The end of the cutter may be square, have a moulded shape, have a solid pilot guide or a ball bearing pilot guide. The ball bearing pilot guide allows for easy cutting as the bearing reduces the friction between the timber and the guide, whereas the solid guide may cause burning and blackening of the timber edge under load.

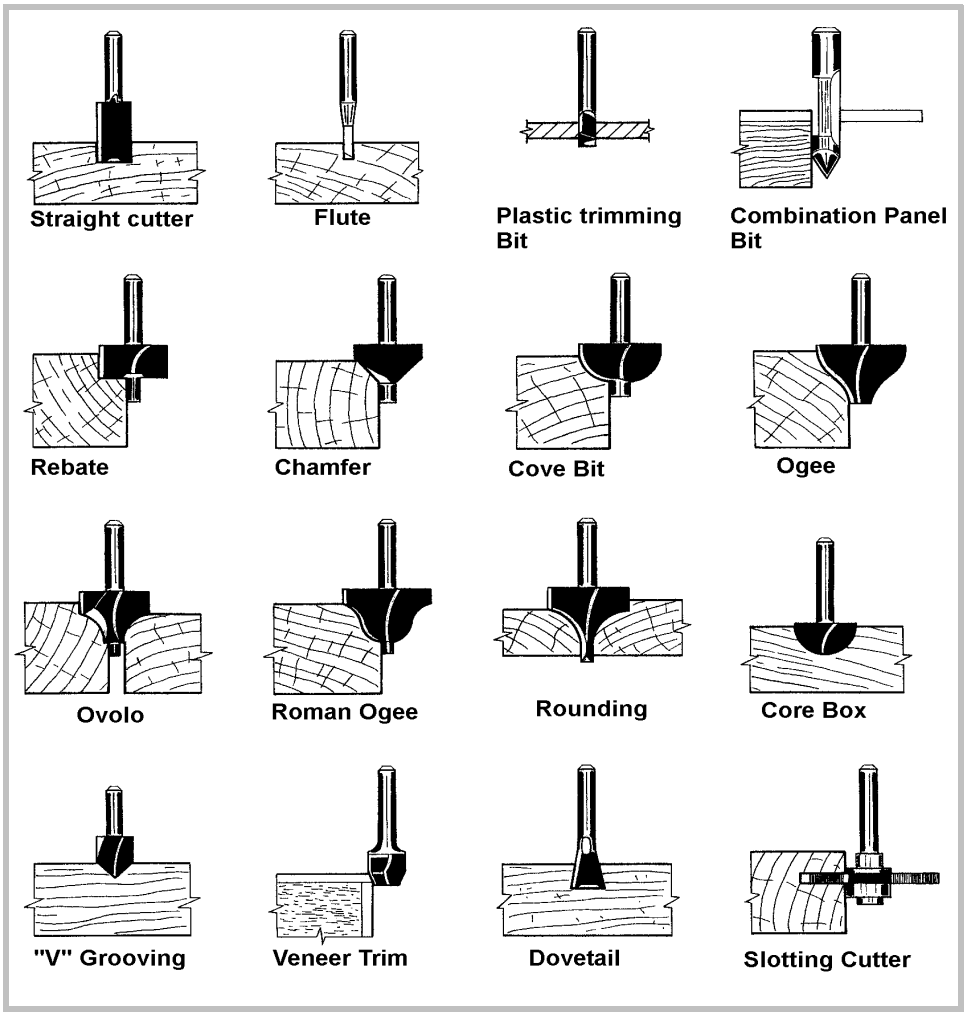


Fig. 23 Variety of standard type cutters available

STORAGE of BITS

Bits should be stored separately in the plastic pouches provided with their purchase or set into holes, with the cutting edge facing up and not touching other bits, formed in sheet material inside a box with a lid. This will prevent cutter edge damage and reduce rust damage to the bits.

SAFETY TIPS FOR THE OPERATOR

- make sure the job is held firmly in a vice or clamped to a bench to allow the operator to use both hands on the router at all times, especially when the router is first started as high powered routers have a strong kick;
- always wear safety goggles to prevent fine splinters being thrown back into the eyes, wear ear muffs or ear plugs to prevent ear damage as the motor emits a high frequency noise and wear a respirator as sharp cutters churn out high volumes of fine dust on manufactured board products;

  ***Note**: Workshops should be fitted with proper dust extraction systems or the router should be fitted with a dust collection bag.*

- never start the router with the cutter in contact with the job as it will kick and cause damage to the job and possibly injure the operator;
- always remove the plug from the power socket when changing bits or making adjustments as the trigger may be accidentally turned. This is particularly important when using routers with a side toggle type switch;
- insert the shank of the cutter as deep as it will go, i.e. at least 15 mm, and make sure it is firmly locked into place by tightening the collet nut with the correct spanners;

  ***Note**: Finger tightening is not acceptable.*

- always use sharp cutters to reduce the strain on the router motor and to prevent burning of the timber during cutting. The motor speed should remain constant while in use and the cutter should be pulled back if it starts to labour, which will allow the rev's to build again. If the feed is too slow it may create friction, which may lead to the timber burning. Maintain a steady feed at all times;
- when cutting along an edge, the router should be moved from left to right to avoid chattering, vibration or kicking out which results from feeding against the cutting action of the router bit;
- when a length of timber is to be edge formed all round it is preferable to form the end grain first. This allows for any splintering which may occur at the end of the cut to be removed when the sides are run through. Alternatively, the cut may be worked against the feed at the end, just enough to form the shape of the mould, then cut as normal from left to right with the feed. This prevents the end of the cut from splitting out; and
- always use the spanners provided to tighten or loosen the cutter in the collet assembly, i.e. the larger locking spanner on the spindle nut and the collet spanner on the collet nut.

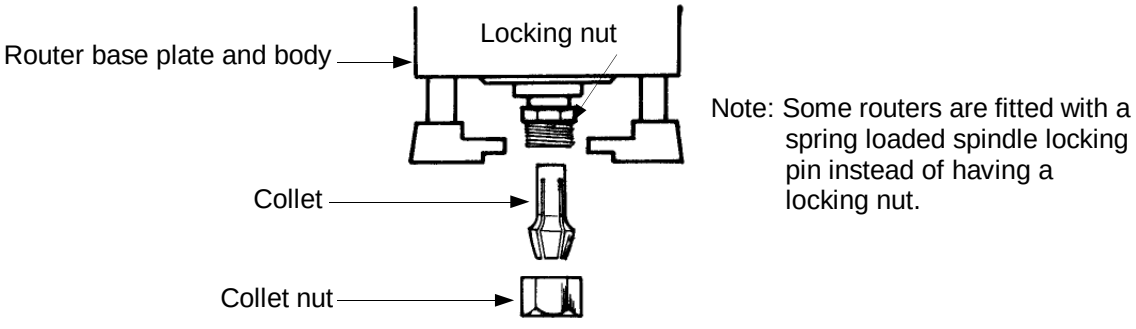


Fig. 24 Tightening and loosening the collet assembly

PORTABLE POWER PLANER

The power planer is a very high speed tool with a cutting head which revolves at between 12,000 - 16,000 revolutions per minute. The width of cut on most common types available is 82 mm, 110 mm or 155 mm. The depth of cut is variable but is limited when rebating due to the projection of housings and guards on the sides of the planer.

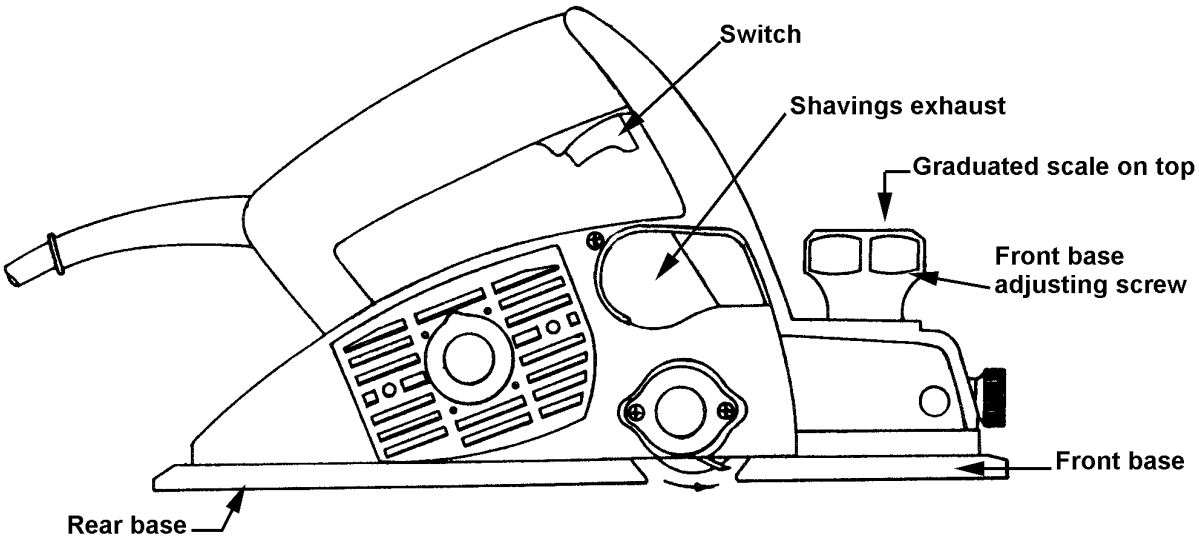


Fig. 25 Parts of the portable power planer

PARTS

Rotating cutter head

Usually consists of two cutter blades, which are bolt fixed on opposite sides to a cylindrical cutter head. The head rotates in a downward direction when the blades pass the rear base or heel and in an upward direction when the blades pass the front base or toe. The blades are set so they contact the timber at the same point on each rotation, which allows the cutting work to be shared by both blades.

Fixed rear base (Heel)

This provides a stable foot for the planer similar to that of the common bench hand planes. The cutters are set so they are flush with this base so the planer can pass over the timber at a constant depth.

Adjustable front base (Toe)

This is where the depth of the cut is controlled. The front adjusting screw knob may be turned to allow raising or lowering of this base. There is a graduated scale at the base of the adjusting knob, which is usually set in millimetres so a controlled depth of cut can be maintained.

Body handle

This is where the operating trigger is located and allows the operator to hold the planer with both hands and depress the trigger at the same time. It also allows pressure to be maintained at the rear of the planer once the front base is no longer in contact with the job, to prevent rocking during use.

PLANER USES

- **Light dressing** — The planer may be used to remove the rough sawn surface of timber and dress down to size ready for final finishing and touching up with a hand plane, prior to sanding. It may also be used to dress the edges of timber doors during the door fitting/hanging process.

- **Rebating** — The planer may be used to cut shallow rebates on the edge of timber, when used with the adjustable fence guide. The final depth of the rebate is governed by the planer body projections on the rebate side.

- **Chamfering** — The planer may be used to cut chamfers or splays on the edge of timber either by judging the angle freehand or using a special chamfer guide fitted to the front of the planer.

OPERATION OF THE PLANER

LIGHT DRESSING

STEP 1 Secure the timber in a vice, cramp it down or fit a stop block at the front end as the cutting action of the planer tends to push the timber forward.

STEP 2 Adjust the depth of the front base to suit the job. It should be noted that the planer performs more efficiently when not under load, therefore a minimum of depth and a greater number of passes is the best approach. This is even more critical when planing very hard timbers.

STEP 3 Place the front base on the timber, making sure the blades are not touching the end, then depress the trigger allowing it to gain full speed. Push forward in a steady motion, while maintaining pressure on the front until the whole planer is supported on the timber. The position of the hands is usually the left hand on the front adjusting knob and the right on the rear handle and trigger, but this position may be swapped for left handed use.

STEP 4 When the planer is near the end of the timber, transfer the main pressure to the rear handle. This will allow the front base to pass off the end without tipping, which causes the cutters to bight into the timber and damage the job.
When the cutters are no longer in contact with the timber, release the trigger, allow the cutter to stop rotating, then remove the planer and rest it on its side or rest the front base on a block.

Note: *When planing wide boards it will be necessary to make several passes across the width of the timber while maintaining the same depth setting. Ensure each pass overlaps the previous one while maintaining a steady flat angle so the edge of the cutters does not dig into the timber as this results in a score mark which requires further planing to remove it.*

Fig. 26 Using the planer for light dressing

REBATING

STEP 1 Secure the timber in a vice or to a flat surface, by cramping or tack nailing.

STEP 2 With the planer unplugged, set the depth and the distance of the adjustable fence from the edge.

Check for correct set up by planing a small area on a scrap piece of timber, make adjustments as required.

***Note**: Only cut small amounts of depth in each pass, i.e. maximum of 3 mm, and follow the same starting and finishing steps as for light dressing.*

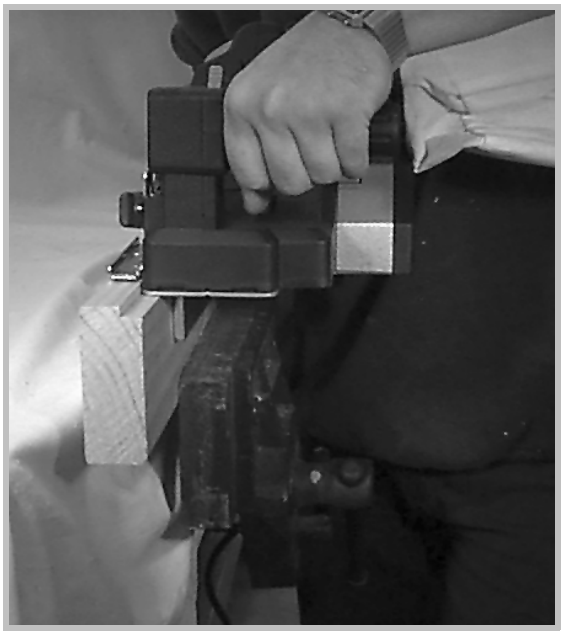


Fig. 27 Using the planner for rebating

CHAMFERING

STEP 1 Secure the timber in a vice or to a flat surface, by cramping or tack nailing.

STEP 2 With the planer unplugged, clamp the chamfer guide to the front base and set the depth of cut required. The planer may also be used without the chamfer guide to create chamfers or splays at any angle, however this tends not to be as accurate as it is difficult to maintain a constant freehand angle while planing. However, where the arris is to be removed only, i.e. one light pass over the edge, freehand planing without the guide is the most suitable.

Note: *Follow the same starting and finishing procedures as for light dressing.*

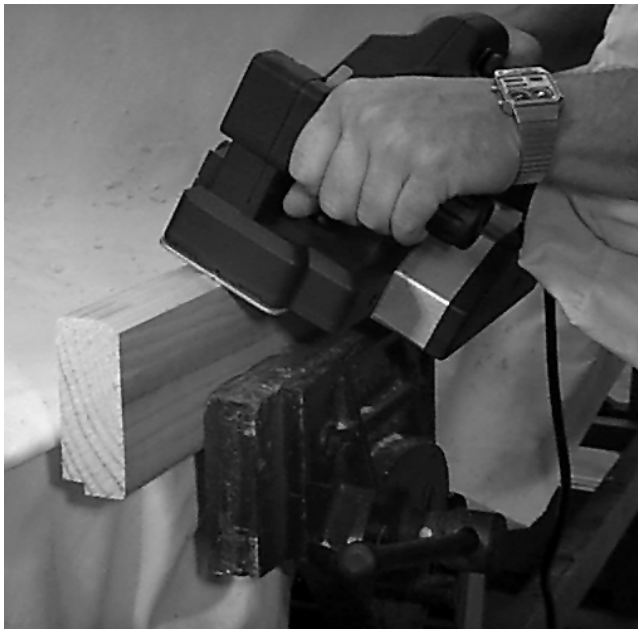


Fig. 28 Using the planer for chamfering

Protecting the Cutters

When the planer is not in use but the blade is still protruding, it should be laid on its side or have the front of the base resting on a block. Resting the front on a block is the safest method as the blade is always facing down rather than being exposed when on its side.

Fig. 29 Planer on a block while not in use

SAFE OPERATION AND USE OF THE PORTABLE POWER PLANER

To use the portable power planer ***CORRECTLY*** and ***SAFELY*** you **MUST:**

- always wear safety glasses and operate the machine with both hands;
- rest the toe of the plane on a block of scrap timber when not in use to prevent accidental contact with the cutters and to provide protection to the cutting edges;
- keep fingers clear of the underside of the base, cutters and exhaust chute;
- do not force the planer or try to remove excessive amounts of waste as it may overload the motor and tear the grain in the timber;
- make sure the cutters are sharp and correctly adjusted for maximum performance; and
- always wait until the motor has stopped before removing the planer from the job.

MAINTAINING THE CUTTERS

SHARPENING the CUTTERS

When the cutters are gapped or very worn they will require grinding. This may be carried out using the supplied grinding holder attachment and following the manufacturers instructions. If the cutters have tungsten carbide edges they should be sent away to a specialist for grinding.
Honing and regular touching up to keep a keen edge may be carried out by the operator. Using the honing guide, which is usually supplied in the box with a new planer, follow the steps below:

STEP 1 The cutters should be honed as a pair to ensure the same angle on each blade. Insert the cutters into the honing guide making sure that each blade is fitted in the same position, by aligning the back of cutter with the shoulders of the guide.

STEP 2 Lubricate the oilstone with light oil. Place the edge of the cutters on the oilstone and move them in a circular motion so wear is even over the stone.

STEP 3 Remove the cutters, lay the back of each one flat on the oilstone and rub them lightly to remove the burr from the back.

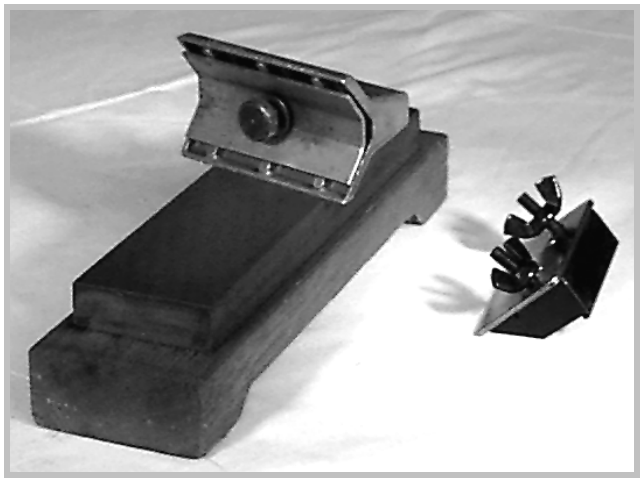


Fig. 30 Honing guides used on the oilstone

REPLACING CUTTER BLADES

Cutter assembly and adjustment varies between brands but the following details outline the general procedures:

STEP 1 Place the cutter blades on the cutter head, insert the cutter blade screws where applicable and tighten into position.

STEP 2 Fit the cutter blade holder onto the cutter head and insert the screws. Do not completely tighten at this point as some adjustment may need to be carried out.

STEP 3 Hold a plastic or timber straight edge on the rear fixed base so it passes over the cutting head on one side. Turn the cutter blade adjusting screw on that side until the edge of the blade is just touching the straight edge. Repeat this operation for the other edge of the same blade. When both sides of the blade are parallel and in line with the base tighten the blade holder bolts firmly.

STEP 4 Repeat the same procedure for the opposite cutter blade and check for final alignment.
Remember maintenance should be carried as per the manufactures specifications.

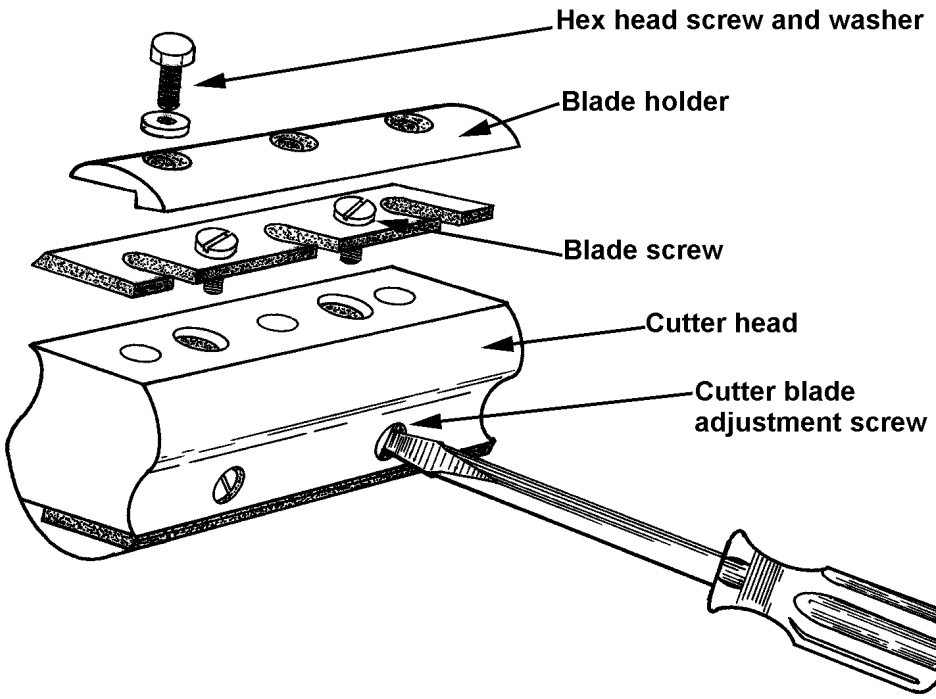


Fig. 31 Cutter head assembly and method of adjustment

RADIAL ARM SAW

This large portable saw, which usually requires two persons to move it about safely, is used for a variety of on-site functions. It may be set up for simply cross cutting or docking timber to length, used to trench wall plates or create compound cuts for the ends of rafters.
The blades are normally plain steel in sizes ranging from 300 up to 500 mm in diameter, however they may be interchanged with tungsten tipped blades or fitted with fixed width or adjustable trenching heads (for trenching wall plates).
These saws are available with steel framed extension tables with rollers 300 to 600 mm wide x 1500 to 3000 mm long. Other alternatives include individual roller stands or purpose built timber extension tables with a plywood surface.

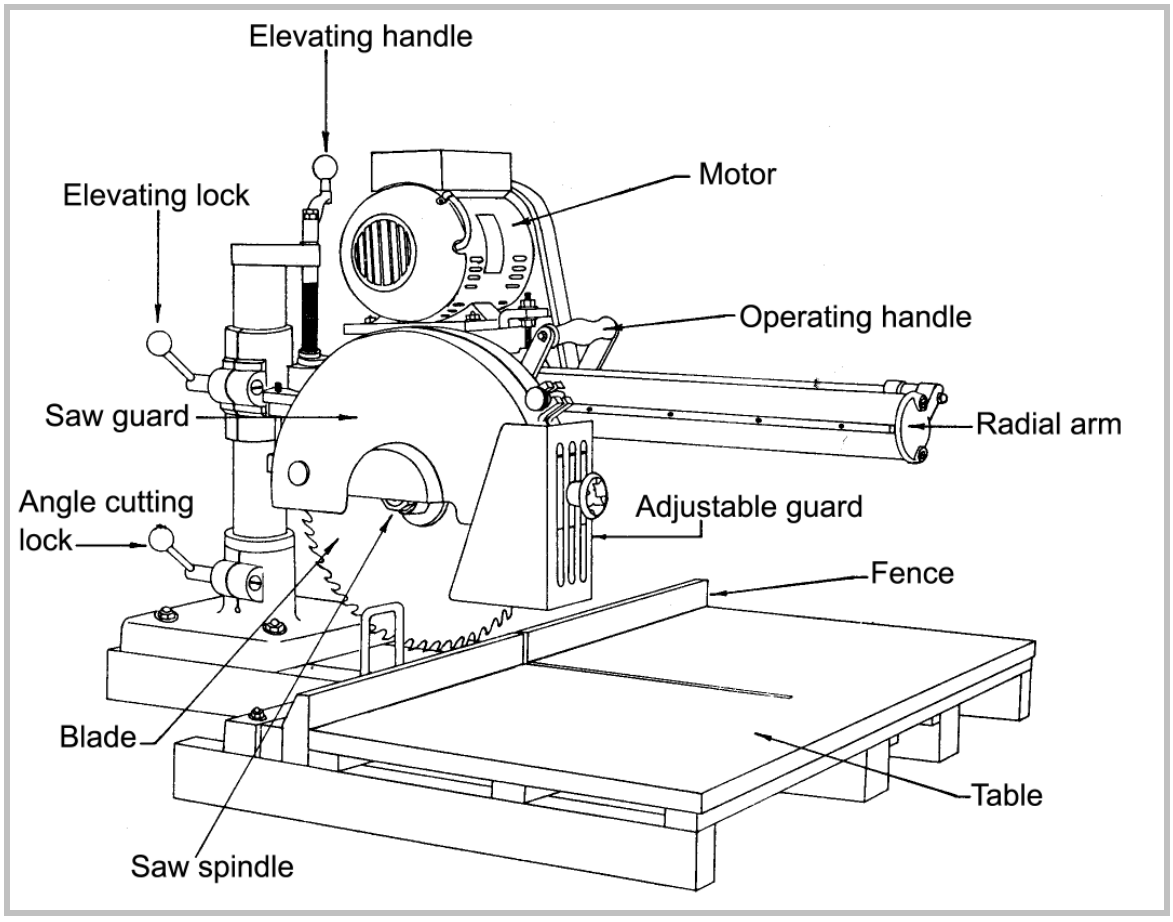


Fig. 32 Radial arm components

MAIN PARTS OF THE SAW

Elevating handle - This is used to raise or lower the radial arm, which supports the motor, blade and spindle. Once the height is established for the job, the Elevating lock handle is used to prevent further movement.

Angle cutting lock - This is used to allow the radial arm to swing from side to side, which will allow angle cutting. Once the desired angle is achieved, usually up to 45°, the locking handle is tightened to prevent further movement.

Saw guard - This is a metal cover placed over the top of the blade to protect the operator. It is hinged at the back to allow it to be opened fully when changing the blade or heads.

Adjustable guard - This is a height adjustable guard to reduce the exposure of the blade at the front. It should be set just clear of the fence to provide maximum protection.

Fence - This upturn provides a horizontal support for the material being cut to ensure it remains at the correct angle to the blade and to prevent it moving during cutting operations.

Table - This is a flat surface, usually of plywood, which forms part of the base frame. It is usually screw fixed to allow for easy replacement in case of damage or wear and tear on the surface.

Operating handle - This allows the motor and cutting blade assembly to be pulled forward along the radial arm. It is set above the cutting blade for safety.

Saw spindle or arbour - This is the spinning axle driven by the motor via a pulley system. The blade is mounted on the outside and held in place with a locking nut.

Radial arm - This is the main horizontal arm extending to the front, which allows the motor and blade assembly to be moved smoothly and easily towards the operator during cutting operations. There should be a light return spring or rubber fitted to ensure the assembly returns to its safe rest position, i.e. the front of the blade approximately 50 mm in from the face of the fence.

Note: *The blade must always be fitted with the teeth facing the back of the saw to prevent timber being thrust forward towards the operator if the blade jams.*

SAFE USE OF THE RADIAL ARM SAW

Radial arm saws are potentially very dangerous and many accidents have been recorded over the years. The main causes appear to be due to poorly maintained machinery, safety guards being removed, inexperienced operators and a lack of proper safety instruction.

To use the Radial arm saw ***CORRECTLY*** and ***SAFELY*** you ***MUST***:

- Always wear safety glasses/ face shield to protect the eyes from flying debris;
- Always wear hearing protection, i.e. ear muffs or plugs;
- Wear non-slip safety shoes or boots to ensure a firm stance while cutting;
- Only use saw blades rated at or above the speed of the spindle or arbour;
- Only use the accessories designed for the machine being used;
- Stand on the handle side of the saw when cross cutting. Pull the cutting head with the hand nearest the handle;
- Make sure the hand holding the timber being cut is never in line with the cutting blade;
- Return the cutting head completely to the back of the saw table after each cut.

- When ripping, ensure the overall length of the saw table, i.e. both sides of the saw base, is at least twice as long as the length of timber being cut. This will ensure the timber is supported for its full length at all times during cutting;
- Turn the saw off at the power point while any adjustments or changes are being made.

The following should be AVOIDED:

- Do not use a Radial arm saw for ripping unless the spreader, known as a 'riving knife', and anti-kickback devices are provided and properly adjusted;
- Do not take your hand away from the operating handle unless the cutting head is behind the fence;
- Do not remove the timber being cut from the saw table until the blade has been returned to its 'resting' position at the back of the saw table. Always use a stick or rush to remove any scrap from the saw table;
- Do not cut freehand. Always use the table fence or a cramping device to support the timber during cutting;
- Do not use cracked or blunt blades, as this promotes blade shattering and jamming;
- No not leave the saw unattended while its still running.

SET UP and SAFETY CHECKS

- When cross cutting of docking, the front adjustable saw blade guard must be adjusted as close to the top of the table fence as possible without striking it when the saw is drawn across it:

Fig. 33 Setting the height of the adjustable guard

- Before commencing cross cutting or docking ensure the return spring or return device is functioning correctly. The saw assembly must return to it position at rest without assistance.

Note: *If no return device is fitted, the saw table must be slightly tilted to allow the assembly to slide back unassisted.*

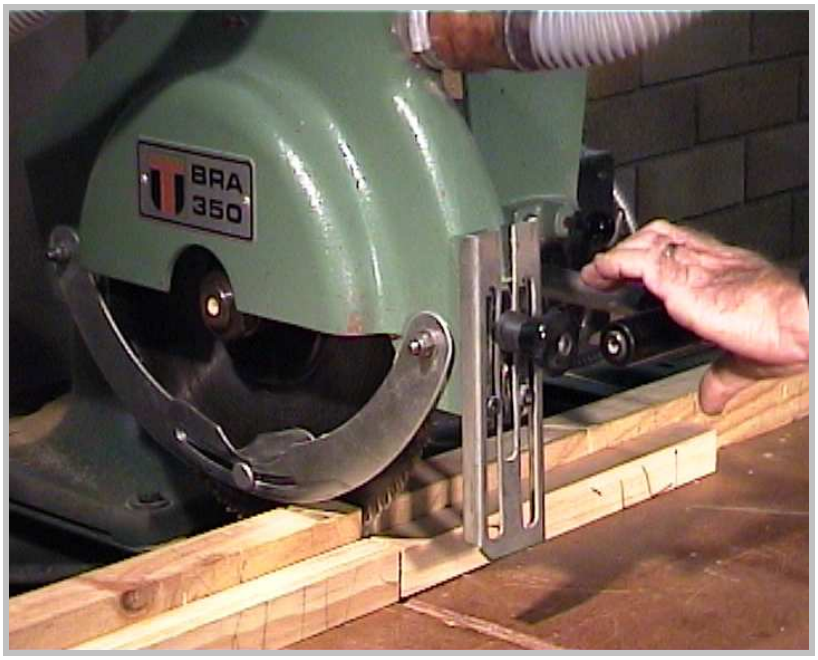


Fig. 34 Check the return device for operation

- There should be a minimum clearance of 50 mm between the blade teeth and the working face of the table fence, when the saw is at rest. This is required to prevent the blade contacting the material being cut before the saw is started and in case it rebounds from its resting position when it hits the cushion or rubber stop.

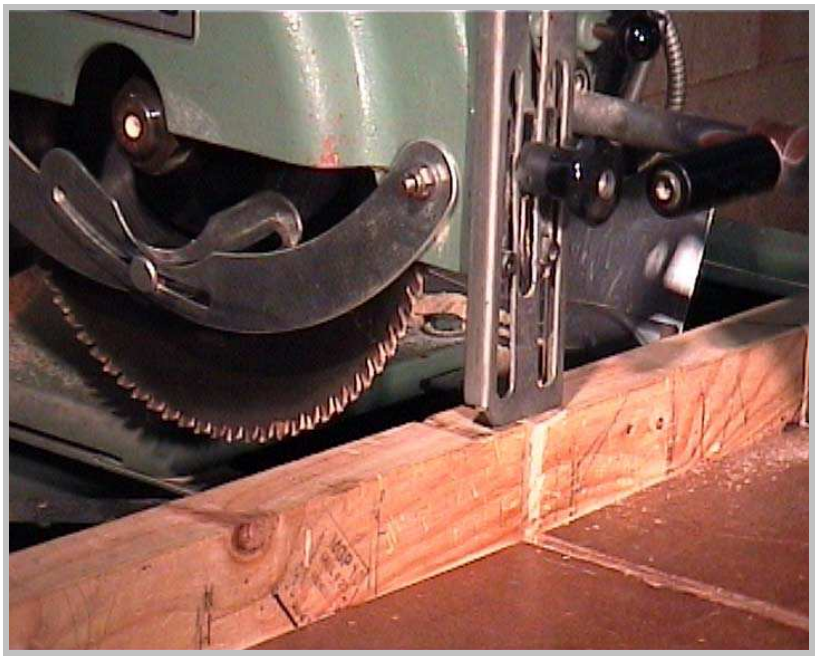


Fig. 35 Maintaining a safety zone at the front of the blade

- When the saw has travelled its maximum cutting path across the table, there should still be at least 100 mm of free bench area remaining. This clearance or buffer zone is required to protect the operator from possible contact with the blade.

Fig. 36 Extent of blade travel across the saw table

- The operator's hands should never pass in front of the blade or cutting path. Waste material should be removed after the saw is at rest, alternatively the operator should use a push stick or brush to remove the waste.

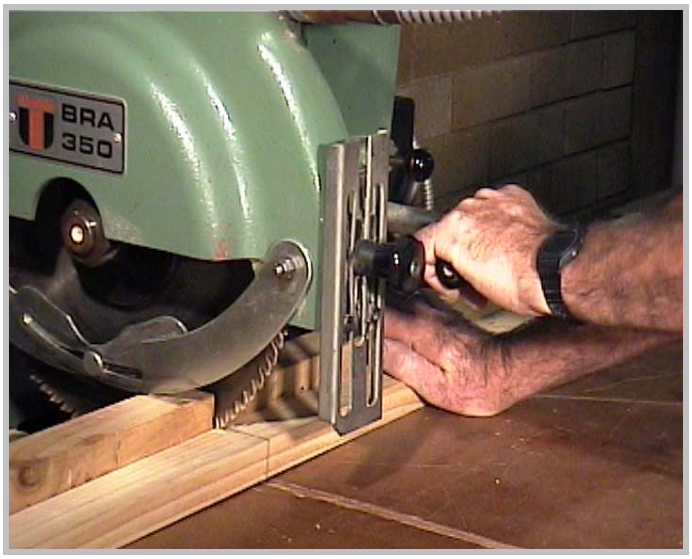


Fig. 37 Correct hand positions and stance for cross cutting

RIPPING SAFELY

- A spreader or 'riving knife' must be fitted at the back of the cutting blade to ensure the timber being ripped does not close on itself after passing through the blade. If the riving knife is not fitted the timber may jam and cause kickback;
- Ensure the overall length of the saw table, i.e. both sides of the saw base, is at least twice as long as the length of timber being ripped. This will ensure the timber is supported for its full length at all times during cutting;
- Make sure the timber is fed into the upward cutting direction of the teeth. The blade should cut into the saw table by several millimetres and the motor/blade assembly should be locked in a position parallel with the saw bench fence;
- An anti-kickback device or 'fingers' should be fitted to the front leading edge of the saw. This device will grab the timber if the blade causes the timber to be thrown back towards the operator; and
- Always use a properly prepared push-stick and not a four-fold rule. The push-stick allows the operator to keep pressure on the feed end of the timber, which prevents the hands going anywhere near the cutting blade.

Fig. 38 Typical push-stick

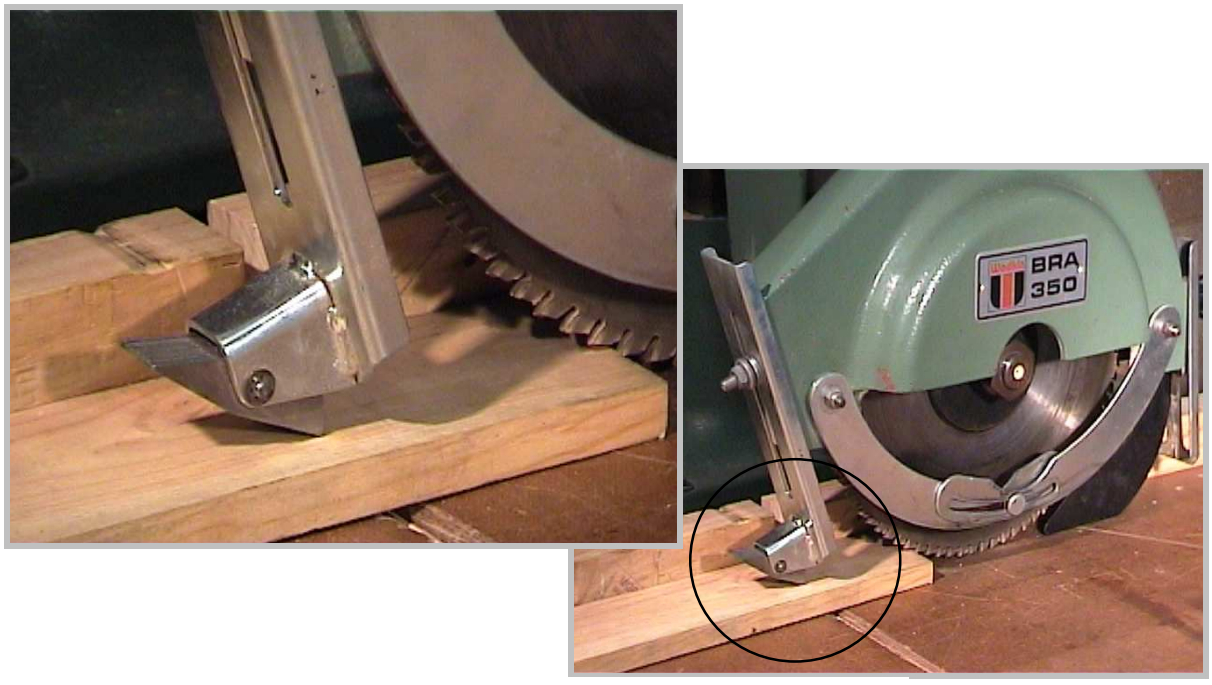


Fig. 39 Saw set up for safe ripping

SAFETY TIPS and SUMMARY

Whenever the Radial arm saw is used, the following procedures, checks and posture is adopted to ensure safe cutting:

- Remove any unnecessary timber and/or tools from the saw table prior to commencement of cutting;
- Do not wear loose clothing, especially long sleeved shirts and jumpers, when working with any machinery;
- Ensure the saw blade is sharp, correctly set, well maintained and fitted with the cutting action arrow pointing in the correct direction;
- Adjust the saw height to allow the blade teeth to cut into the saw table to allow a full clean cut of the timber;
- Set all adjustable guards to provide maximum protection for the operator;
- Check the spring return and ensure the radial arm is lubricated for smooth slide operation of the cutting assembly;
- Measure and mark the timber to the exact length with an 'x' on the waste side;
- If the timber is bowed, the bowed face should be in contact with the saw table to prevent blade jamming;
- If the timber has a spring along one edge, the spring should be placed against the fence to prevent blade jamming;
- Pull the motor/blade assembly handle with the left hand while holding the timber with the right. This will prevent the operator standing in front of the blade during cutting operations;
- Ensure the floor surface around the saw table is free of off-cuts and excessive saw dust;
- Only use the supplied spanners to change blades or make adjustments;
- Stand firmly and as upright as possible;
- Ensure the saw blade is back behind the front of the fence before moving the cut timber;
- Use a push stick or brush to remove any unwanted scraps from the saw table;
- Never leave the machine while the motor is running or the blade is still rotating;
- Switch off the power at the power point to make any adjustments to the saw; and
- Make sure all locking devices are secure before using the machine.

CAUTION

! Trenching heads or Dado cutters are especially dangerous, as they have a tendency to bight into the timber and force their way through the cut. A steady pressure should be maintained to allow the cutters to pass slowly, never force the cutting speed.

! Care must be taken where coarse grain or knots are encountered, as the cutters tend to bight even harder here and this may lead to jumping or jamming.

! If ripping with the radial arm saw can be avoided, it should be avoided. This is a high risk operation due to the action of the saw and the awkward positioning of the operator during the ripping process.

DROP/MITRE and DROP/SLIDE SAWS

DROP/MITRE SAW

This type of saw is commonly used to accurately cut timber, plastics, aluminium and non-ferrous metals at 90° or at horizontal angles of up to 45°.
Angles may also be set using the 'positive stop' settings at 15°, 22.5°, 30°, 45°, (left or right sides) and 0° or 90°.
These saws have a cast iron base for stability and strength and are available in sizes to take blades of 250 mm up to 350 mm diameter.

DROP/SLIDE or COMPOUND MITRE SAW

These saws have similar uses to that of the drop/slide saws with the added advantage of being able to cut angles in both the horizontal and vertical planes.This makes them particularly useful for cutting compound angles for hip roof rafters or other applications where compond cuts are required.
The structure of these saws is similar to the drop/slide although they are capable of cutting angles up to 60° right and 47° left with 'positive stop' settings at 15°, 22.5°, 30°, 45°, (left or right sides) and 0° or 90°.

Note: *All these types are available with dust bags and a clear retractable blade guard.*

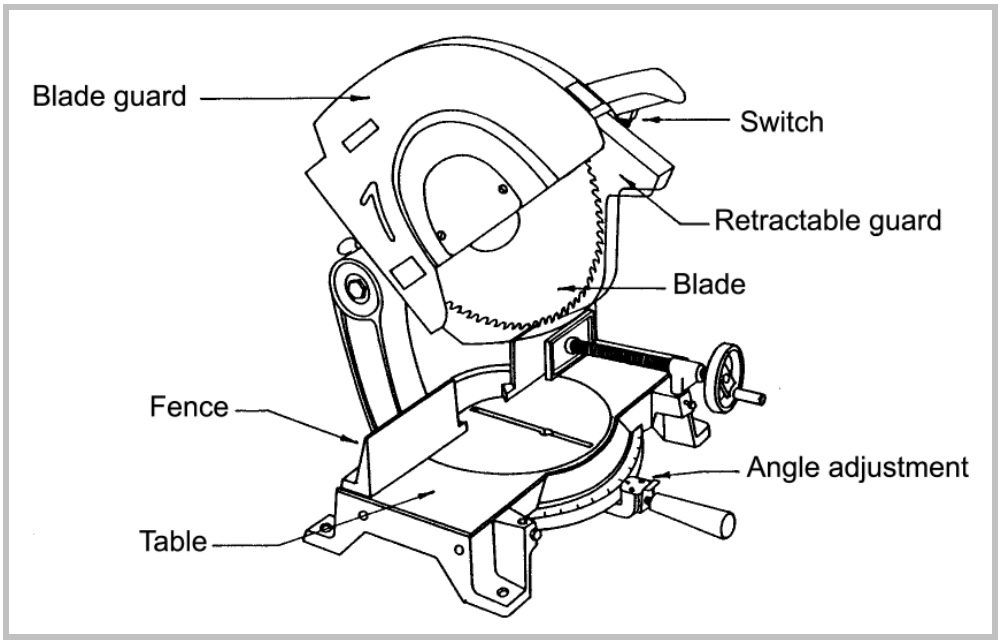


Fig. 40 Parts of the Drop/Mitre saw

MAIN TYPES OF SAWS AVAILABLE

Fig. 41 Compound Mitre saw

Fig. 42 Slide Compound saw

Fig. 43 Dual Slide Compound saw

SAFE BLADE CHANGING

- Check to ensure the saw is unplugged before attempting to change the blade;
- Slide the blade guard back and depress the shaft locking device;
- Use the provided spanner to loosen the hexagonal bolt holding the blade in place;
- Remove the outer locking collar and carefully remove the blade;
- Repeat the procedure in reverse to install the new blade;
- Check to see that the shaft locking device is released and spin the blade by hand to confirm the release; and
- Replace the blade guard into its original position.

SAFETY TIPS and SUMMARY

Whenever the Drop saws are used, the following procedures and checks are adopted to ensure safe cutting:

- Always wear safety glasses or a face shield to protect the eyes from flying debris;
- Always wear hearing protection, i.e. ear muffs or plugs;
- Wear non-slip safety shoes or boots to ensure a firm stance during cutting operations;
- Place the saw on a rigid level bench top or table;
- Lock the head in the lowered position when not in use or during transporting;
- Before each use, check the following:
  - the blade is installed correctly and not damaged;
  - the saw blade tips do not touch the saw base when the saw is fully lowered;
  - the safety guard operates freely;
  - the see-through guard is clean;
  - the mitre clamp grip is firmly tightened, if being used.

- Switch off power at the power point before any maintenance or adjustments are made;
- Check the return spring on the clear guard; and
- Check the return springs on the supporting arm to ensure the motor/blade assembly returns and does not drop freely onto the saw table.

NAIL GUNS

TYPES

There is a wide variety of nail gun types available, which may be sequential trip or coil type. The sequential trip nail gun is considered to be much safer because it cannot be accidentally driven when the trigger is pulled.
Nail guns may be configured to fire when a trigger is pulled, or to fire on contact with an object. The contact firing option is considered to be faster, but is also considered to be more dangerous, as it may fire at unintended targets simply by contact with them.

The nail propulsion method also varies with the most common methods being:

- Compressed gas cylinder or Fuel cell and battery; and
- Compressed air (compressor and hose)

There are many 'purpose-made' nail guns available also, such as:

Bradders/Pinners/Staplers -

These nail guns are used for attaching glazing beads, light mouldings, panelling, trims, picture frames, cane furniture, fixing out, shopfitting, furniture manufacture, cabinet making, door and window trims and upholstery.
(light building, craft, hobby work)

Fig. 45 Typical Bradder

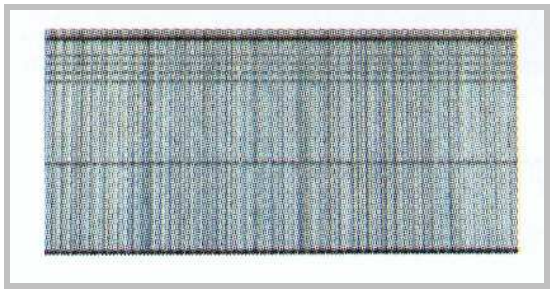


Fig. 44 Typical Brads

Strip Nailers (Framing gun)-

These nail guns are used for framing, roofing, trusses, joists, flooring, decking, steel framing and temporary nailing to green concrete.
(general all-round building work)

Fig. 46 Typical Strip nailer

'T' and Finish Nailers (Fix-out gun)-

These nail guns are used for door and window frames, smooth-edge strips for carpets, timber to light gauge steel, flooring, window manufacture and box making.

(finishing off work)

Fig. 47 Typical 'T' and 'F' Nailer

Corrugated Nailers -

These nail guns are used for butt-jointing timber, truss fixing, door-frame manufacture and furniture assembly.

(simple joint connection work)

Fig. 48 Typical Corrugated Nailer

Coil Nailers -

These nail guns are used for trip-L-grip fixing, ply bracing, fencing, joist hangers, cladding, steel flooring, internal steel framing, sub-flooring, treated pine lattice, crate/pallet/box manufacture and fencing.

(repetitive strong work)

Fig. 49 Typical Coil Nailer

NAILS and FINISHES

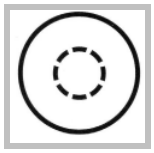
NAILS

Nails or fasteners are available in many forms to suit the purpose for which they were designed. All have the following in common:

- Head; *(round, 'D' or 'T'-shaped)*
- Shank; *(smooth or textured)*
- Point; *(pointed or blunt)*
- Coating; *(glue, cement, etc. to enhance holding power)*
- System of collation; *(how they are held together)*
- Plating method; *(to prevent corrosion)*

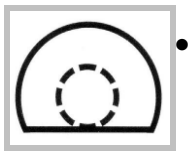
Nail Heads:

ROUND



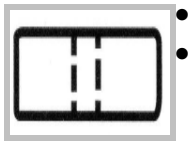
- Conventional nail head shape;
- Best suited for applications requiring higher pull-through resistance;
- Offers the most aesthetically pleasing result.

D-HEAD



- Offers similar performance to the round head nail but enables fasteners to be collated hard against each other, when prepared in strip form;
- The denser collation system ensures much greater magazine capacity, which results in reduced loading frequency.

T-HEAD



- Moderate pull-through resistance;
- Limited damage to timber surface;
- Available as 'T' and 'Finish' nails *('Finish' nails have a narrower 'T')*

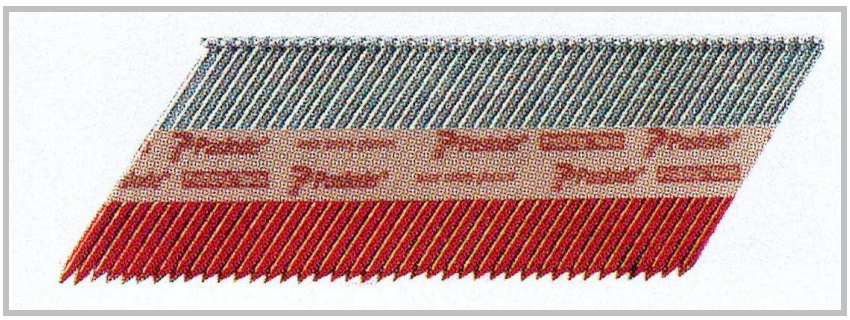
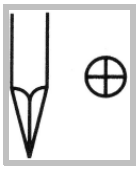


Fig. 50 Typical 'D-Head' nail strip

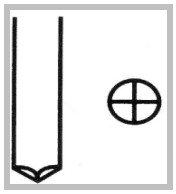
Nail Shank:

SMOOTH



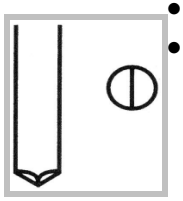
- Available in a wide range of lengths and shank diameters;
- Smooth shank nails provide excellent holding power in most timber applications.

RING



- When compared to nails, which are not polymer or glue coated, ring shank nails provide superior withdrawal resistance in softwood applications. This is especially important when the timber has a high moisture content.
- Nails of this type require the greatest driving power.

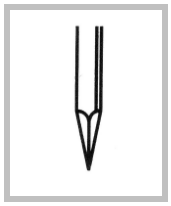
SCREW or TWIST



- Excellent for hardwood applications such as pallets;
- Require less driving force than ring shank nails.

Nail Points:

DIAMOND

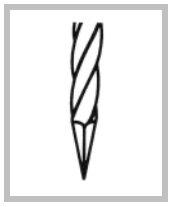


- The most common and easiest to drive;
- The diamond point can, however, contribute to splitting in some applications.

BLUNT DIAMOND

- Allows minimal penetration resistance when the nail is driven;
- Helps to reduce the splitting encountered with diamond point fasteners.

BLUNT CHISEL



- Requires the most driving power;
- Almost eliminates timber splitting;
- Not suitable for clinching applications.

COLLATION of NAILS

The term *'Collation'* refers to the method used to hold the nails together to provide the convenience of loading grouped nails, as opposed to loading individual nails.

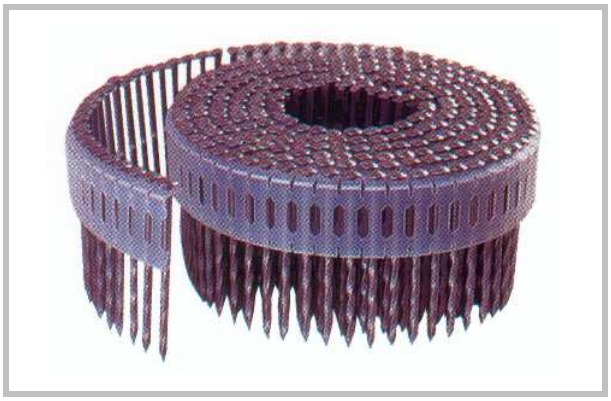
There are two (2) basic collation systems, i.e. 'Coil' and 'Strip'.

COIL NAILS

Coil nailers are generally used for high volume nailing applications such as packaging and fencing.
The high magazine capacity offered by coil nailers, e.g. up to 400 nails at a time, limits the down or lost time required for regular re-loading.

There are three basic types for the collation of coiled nails:

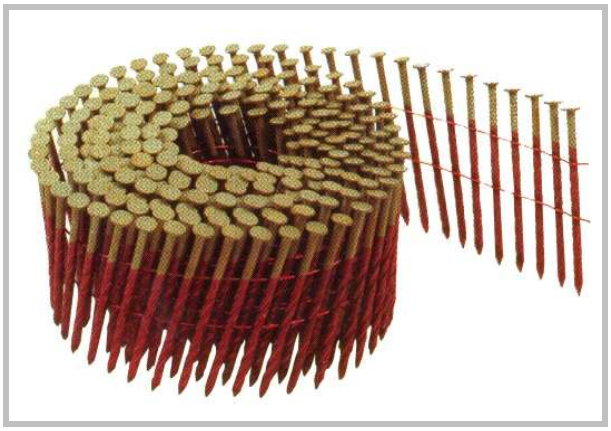
Plastic Tape



Advantages:

- No waste material around head of nail after nailing;
- Cleaner, better looking jobs.
- Ideal for visually exposed work such as decking;
- Ensures positive delivery of the nail every time.

Wire Weld



Advantages:

- Offers a high number of fasteners per coil due to thin wire used.

Extruded Plastic Bead

Advantages:

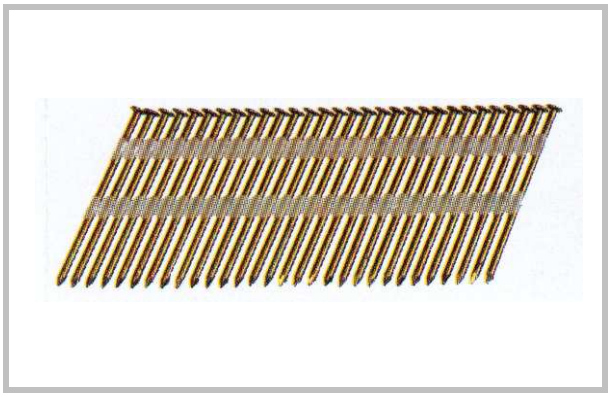
- Positive delivery of fastener to nailer nose;
- High volume load.

STRIP NAILS

Generally limited to larger nails such as those used for construction framing. The lower load volumes of the strip nailers generally result in a lower weight tool, providing ease of use on building sites.

There are two basic types for the collation of strip nails:

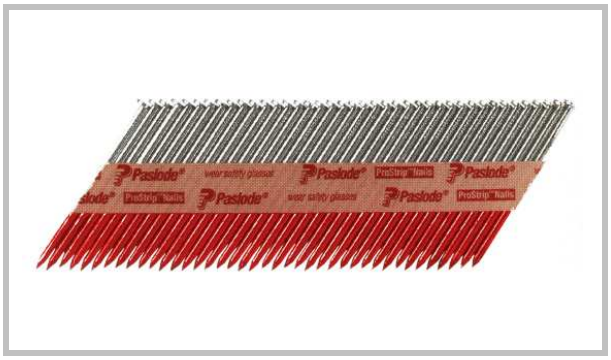
Extruded Plastic Bead



Advantages:

- This system enables round headed nails to be collated for Duo-Fast strip nailers;
- Useful for applications where round headed nails are required.

Plastic Laminate



Advantages:

- Suitable for collating ‘D-Head’ nails;
- Eliminates plastic and wire waste left all over the site. The collation material ends up embedded in the timber.

NAIL COATINGS

A standard polymer or glue coating is applied to the nail shank. This coating performs two functions:

- Reduces driving force to enable fasteners to be driven, using less energy, or be driven deeper.
- Greatly increases resistance to withdrawal, in some cases by as much as 50%.

PLATED FINISHES

Plated finishes are provided where the nails will be exposed to the elements, acids or reaction with other materials, which will lead to corrosion of the nails.

Zinc Plated Wire *(also known as galvanised or galvanised wire)*

- Simplest and cheapest method to reduce corrosion;
- Identified by a bright silver finish on heads and points;
- Coating thickness is 2 to 3 microns of zinc;
- Used on most brads and staples.

Electroplate *(also known as EP, ZP, Zinc plate, Electro galvanising)*

- Extremely common and economic method of providing moderate corrosion resistance;
- Identified by a lustrous silver or gold finish;
- Coating thickness is 6 to 9 microns of zinc.

Dacrotised

- Polymer coating used to bond zinc flakes to the nail surface;
- Identified as a dullish silver-white finish;
- Typically used for internal steel framing, sub-flooring and internal fixing.

Hot Dipped Galvanised *(also known as just galvanised)*

- Most widely accepted method of providing long term corrosion resistance to metallic objects.
- Identified by a dull grey colour and a rough texture;
- Typical coating thickness is 40 microns.

Galvanised and Dacrotised

- Nails are first galvanised, then dacrotised;
- Typically used for external applications such as fences, decks and fascias.

Mechanically Galvanised *(also known as mechanical plated)*

- Highly effective method of providing long term corrosion resistance, whilst maintaining a high quality appearance and finish.
- Nails are coated with 25 microns of 75% zinc and 25% tin;
- Suitable for use with timber treated with CCA (Copper, Chromium and Arsenic salts);
- Identified by a dull grey olive finish and a smoother texture than hot dipped galvanising.

Stainless Steel

- Nails and/or staples are manufactured from stainless steel;
- Used for extreme environments where corrosion resistance is essential.

POWER SOURCE for NAIL GUNS

Nail guns are operated by two main methods;

1. Compressed air
2. Impulse fuel cell

Compressed Air

Consists of a portable air compressor and hoses to deliver air under pressure.
It is critical to use the correct oil to ensure long term operation of the compressor and ensure that the moisture removal system is appropriate for the system being used.

Selection of an Appropriate Air Compressor

The following should be considered before the compressor is purchased:

- Add up the air requirements for all the air operated tools/devices to be used.
- Refer to the manufacturers data/tables to verify the capacity of the compressor required to operate the necessary tools;
- For general power tools use, a reciprocating type would be suitable and for continuous operation a rotary type would be used.

Fig. 51 Typical portable air compressor

Impulse Fuel Cell

Fuel cells consist of compressed liquefied gas, which is flammable. They are normally available in packs of two (2) and used in conjunction with a re-chargeable battery.
Typically, the red cells are used for framing nailers and the yellow cells for finish nailers.

Fig. 52 Typical fuel cells

SAFE OPERATION AND USE OF PNEUMATIC NAIL GUNS

To use nail guns ***CORRECTLY*** and ***SAFELY*** you **MUST:**

- Review the owner's manual carefully;
- Receive instruction from someone who is familiar with it's safe operation;
- Always wear safety glasses and ear muffs/plugs;
- Do not hold the trigger down unless about to fire, especially when descending ladders;
- Keep area clear of other workers where possible and exercise extreme care around other workers if they are in the area;
- Never point the tool at anyone. The tool should be treated like a firearm, i.e. never assume its empty;
- Disconnect the air hose before clearing a jam or making adjustments;
- Do not fire the tool unless the nose is pressed firmly against the timber;
- Only use compressed air with the power tool, not bottled gas;
- Keep your free hand safely out of the way during use;
- Do not operate the tool around flammables;
- Nail top to bottom, when nailing wall sheeting in a vertical position;
- When nailing tile battens work from the bottom up to the ridge, to prevent accidental walking off the edge of the roof;
- Move forward, not backward, when nailing horizontal areas;
- Secure the hose when working on scaffolding, to prevent the weight of the hose from dragging the tool off the scaffold, when placed on the platform, and
- Never direct air streams at any exposed part of the body or body openings, as this may lead to serious injury or even death.

GLOSSARY OF TERMS

A.C. - Alternating Current - power supply is via 240V household power points, a temporary power board, generator, etc.

Chamfer - A 45° section of the timber edge is removed along the length of the piece to form an angled edge known as a chamfer.

Collet - A split sided metal liner which fits into the spindle of a router to hold the router bit. When the collet nut is tightened it squeezes the split liner onto the bit tightly to prevent the bit from coming loose.

Crosscutting - The action of sawing timber across the grain

Cupping - This is a timber defect, which causes the timber to curve across it's width.

D.C. - Direct current - power supply is via battery power such as used in battery operated drills, screwdrivers, etc.

Fence - A term used to describe a guide attachment for portable power tools to ensure parallel cutting is possible.

Fluting - This is a method of decoration for surfaces by creating a number of shallow, parallel, concave grooves or channels known as flutes.

Gulleting - This is the process of forming concave areas between the teeth of a circular saw blade, which are designed to allow the sawdust from the cut to be easily and quickly removed. Gulleting is a specialist job performed by a Saw Doctor.

Gumming - This is the action of removing gum, resin, filing nicks, etc. from the gullet of the power saw blade during the sharpening process. It may be carried out by light filing or grinding with a small abrasive tool.

Kickback - This term is applied to the action of a power saw recoiling when the blade jams in the cut. It is referred to as *kickout* when a router cutter jams or the feed in is against the rotation of the spindle.

Knots - These are classified as timber defects when they are loose or decayed and occur where branch growth begins in a tree. They are very prominent in timbers such as Cypress pine and Slash pine.

Mortice - This is a rectangular slot created in or through the edge of timber members to allow a tongue or tenon to be fitted, which creates a joint. It may also be created to allow the insertion of a mortice lock in a door.

Pocket cutting - This is where a power saw or jig saw is used to cut out a section in sheet material where the cut does not extend to an edge or end. It is like cutting a window in a sheet.

Protractor - This is a geometric device, which is graduated in degrees, to allow angles to be created or measured. It may also refer to a hand held adjustable guide used when cutting timber with a power saw, which creates an accurate angle on the face of the timber.

R.C.D. - Residual Current Device, which is placed in temporary power boards to prevent electrocution from faulty appliances. It acts as a trip to the affected circuit. These devices are also a mandatory inclusion in all new residential buildings, mounted in the main switch board, as this was made law in December 1991.

Ripping - This is the action of cutting timber along the length or in the same direction as the grain.

Riving knife - This is a fixed narrow blade attached to the rear of a power saw or bench saw designed to prevent the timber closing in on the saw blade during the ripping process, which may otherwise cause jamming of the blade.

Template - This may be a guide, pattern, mould or a jig, which is used to repeat a particular shape many times accurately.

Tungsten carbide - This is a heavy, steel-grey, infusible metal used to tip power saw blades and other cutting tools. It retains its cutting edge better than ordinary tool steel.

FURTHER READING

Barrington, J., D. Mylius & S. Arden, 1989, *Book 1 Practical Australian Carpentry, Framing and Construction*, McGraw Hill, Sydney

Brown, B. and H. Slatyer, 1985, First published 1958, Second edition 1966, Third edition 1975, Fourth edition 1981, Fifth edition 1985, *The Australian Carpenter and Joiner - Volume 1,* Standard Publishing Co Pty Ltd, Victoria.

Matthews, John, 1993, *Health and Safety at Work*, Pluto Press, Leichhardt.

National Committee on Rationalised Building, 1994, Fourth edition, *Glossary of Building Terms*, Standards Australia, Sydney.

Standards Association of Australia, 1974, *AS 1339-1974:Manual Handling of Materials*, Standards Australia, North Sydney.

Standards Association of Australia, 1977, AS 1895: *Code of Practice for Guarding and Safe Use of Portable Electric Power Tools for Domestic Use*, Standards Australia, North Sydney.

Standards Association of Australia, 1989, AS 1627.2: *Power Tool Cleaning*, Standards Australia, North Sydney.

Standards Association of Australia, 1983, *AS 1319-1983: Safety Signs for the Occupational Environment*, Standards Australia, North Sydney.

Teachers of Building, First Edition - 1996 Reprinted 1997, 1998, 2nd Edition - 1999, *Basic Building and Construction Skills*, Addison Wesley Longman Australia Pty Ltd , South Melbourne.

VIDEOS

Construction and Transport Division, Power Planers and Routers (CTV03), Portable Power Saws (CTV09) available from Resource Distribution, Yagoona.